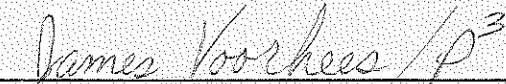


**RCRA FACILITY INVESTIGATION  
FOR MACDERMID INCORPORATED AT THE  
FERNDALE, MICHIGAN, FACILITY**

Submitted to:

MacDermid Incorporated  
Waterbury, Connecticut

OHM Remediation Services Corp.

  
\_\_\_\_\_  
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February 26, 1991  
Project 9961

#371-16

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## EXECUTIVE SUMMARY

MACDERMID, Inc. manufactures metal surface coatings and finishing products which include coatings and etchant for the circuit-board industry, as well as manufacturing various plastic surface coating materials. Recycling operations handle only MACDERMID spent-products brought into the site for recycling/reclaiming from their customers.

The MACDERMID plant is located in Ferndale, Michigan which is a northwest suburban-type manufacturing community of the metropolitan Detroit area. This facility was concurrently issued a Part B Permit by the USEPA and the MDNR on September 24, 1990. This RFI (Task I and II) and the accompanying Draft Work Plan (Task III) have been developed as part of the requirements for the maintenance of a Part B Permit status. The limited size of the site and the three associated SWMUs, the substantial amount of previous data available on the site, and the need to expedite remedial measures, has afforded MACDERMID the opportunity to present this RFI as a three-task project.

The MACDERMID Ferndale facility encompasses 6.5± acres. One building on the site houses all company activities, manufacturing processes, and the recycling operations. Presently there is one hazardous-waste staging/storage area. It is located under the liquid mezzanine area and is used to store products for recycling. There is also a hazardous waste loading and unloading area on the north side of the building. Plans to build an upgraded hazardous-waste storage area on the south side of the building, west of the concrete ramped area have been approved pending a review of the final specifications by the MDNR.

All areas involved with the handling of hazardous waste (those mentioned above) have adequate secondary containment consisting of a concrete floor sloped and/or diked with drainage to the facility wastewater treatment system.

From past knowledge of the facility, three SWMU areas have been described by the USEPA and the MDNR in their review of the RCRA Part B Permit application. They are:

- o SWMU No. 1 = Two Closed Surface Impoundments (i.e. Lagoon Nos. 1 and 2)
- o SWMU No. 2 = Units that Emit Air Contaminants--Incinerator and Scrubbers on Recycle Tanks
- o SWMU No. 3 = Inactive Railroad Spur

All three SWMUs have elevated concentrations of one or more metals associated with the soils in the designated SWMU areas. The more common metals found in the SWMU-related soils were: chromium, copper, zinc, nickel, and lead. The vertical extent of this metals' contamination varies within an interval from approximately 1- to 5-feet deep.

Constituent concentrations in the soils have been compared to action level ranges. These ranges were based on: USEPA proposed action levels (55 FR 30868), action level concentrations based on contaminant levels within the background reading (Gosset Student T-Test), and action levels calculated using WMD/MDNR Michigan background soil survey for clays in the Erie glacial lobe. The action level ranges are used as guidelines for site constituent concentration evaluation for the recommendation of possible remedial measures.

Organic constituent concentrations have been compared to action level ranges established according to the proposed USEPA action levels (55 FR 30868) for organics and the MDNR Type B soils cleanup criteria. Soil samples collected from SWMU No. 1 in the previous location of Lagoon No. 1 (lagoon farthest west) have been analyzed for organic constituent concentrations. Highest reported organic constituent concentrations were associated with samples collected from the 9.0- to 10.5-foot sampling interval. Organic contaminant constituents measured in the soils using several different laboratory methods consisted of chlorobenzene, chloroform, methylene chloride, chlorobenzene, ethylbenzene, benzoic acid, xylenes, 1,2-dichlorobenzene, naphthalene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, and bis(2-ethylhexyl) phthalate. The organic constituent concentrations that exist at this deeper sample interval may be related to the bottom/sludge deposits of the original lagoon(s). The lagoons were backfilled after being taken out of service in 1976 (Lagoon No. 1) and 1982 (Lagoon No. 2).

Results from computer air emissions modeling (ISCLT) done on the incinerator locations associated with SWMU No. 2 (Units that Emit Air Contaminants), show emission concentrations from the first location (adjacent to the northwest corner of the building, prior to the construction of the 1973 annex) to be coincident with the area where the soil sample for boring (B-6) was collected which had a chromium concentration above the action level range. This concentration of chromium may be related to the original container storage area located directly off the northwest corner of the main building.

The incinerator was relocated on the south side of the building just east of the concrete ramped area (i.e., second location). Emissions from this location were concentrated over the closed surface impoundment area (i.e. lagoon area), according to the ISCLT model run for this second location.

Of the 11 total fume and particulate scrubbers in service at the MACDERMID Ferndale facility, only the 6,000 CFM Duall fume scrubber is used in conjunction with the recycling process. Due to the nature of the materials associated with this air scrubbing process and the adequate efficiency of the scrubber unit, no measurable fugitive emissions can be calculated from this operation, either at the hood or at the ventilation on the roof.

In SWMU No. 3 (Railroad Spur), zinc, chromium, and copper concentrations in the soils exceeded the established action level range limits. These constituents should be more closely associated with the drum/container washing station located east of the concrete ramped area, just east of the SWMU No. 3 area.

Six ground-water monitoring wells were installed at the site from December 1986 through January 1987. The depth to ground water at the site ranged from a high of 0.96 feet in MW6, to a low of 11.24 feet in MW2. Samples of the ground water were collected, filtered in the field and analyzed in the laboratory for the following constituents: arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc phosphorous (total), cyanide (total), selenium, and pH in monitor wells MW1, MW2, MW3 and MW4. Using USEPA's most current proposed Primary Drinking Water Standards List as a standard for the evaluation of the site constituent concentrations, the concentration of chromium was slightly over the MCL listed. Nickel and zinc had measurable concentrations on the analysis, but no MCLs were available on these two constituents. All other constituents analyzed in the ground-water samples were below detection limits.

In the early stages of MACDERMID's site investigation program, (December 1986) an analysis for organics was run on a ground-water sample collected from a test boring (TB7) located in the area of Lagoon No. 1. All constituents were below detection limits.

The local, near surface geology of this area is composed of glacial drift/till material which is deposited just 1- to 2-feet below the surface soils, and extends down to approximately 150 feet. The Antrim Shale, from the late Devonian Age subcrops beneath the glacial drift/till. Geology at the site, according to the available boring logs, indicates a sandy clay to clayey sand down to approximately 7.0- to 13.25-feet deep. Directly beneath the sandy clay/clayey sand a stiff, moist, blue clay is encountered. This sealing/low permeability, blue clay is uniformly deposited across the site. The clay is locally estimated to be 60- to 70-feet thick, according to previously reported data (IPC Report, April 1987).



Hydrogeologic conditions are very complex due to the limited extent of the shallow, unconfined aquifers associated with the glacial drift/till. Hydraulic conductivities (permeabilities) are generally low and water yields are restricted by the limited flow regimes.

Based on the low migration potential of metals in the soil, migration of these metals off site would be difficult. The ground-water samples analyzed from monitoring wells MW1 through MW4 establish that the ground water has not been impacted by contaminants from the site, most conclusively from the metals.

Alternatives for remediation that are applicable to the site are:

- o Excavation, transportation, and off-site disposal
- o Containment
- o No action

Excavation, transportation and disposal is the most efficient and effective method of removing the presently defined contamination (metals and organics) problem.

Another remediation alternative is on-site containment of the metals and organic constituent contamination. Barrier walls could be constructed on the downgradient side of the SWMU areas down to the sealing, stiff, blue clay. These impermeable walls could be constructed of concrete with a sealant, or in-situ soil vitrification might be considered to stabilize the downgradient portion of a contaminated area. Capping might also be another method of containment to be considered in conjunction with containment. This would prevent possible migration enhanced due to surface runoff and percolation through the soils.

Another alternative for remediation of this site is a no action approach. The nature of the native site soils, the limited extent and yields of the unconfined shallow glacial drift/till aquifers, and the low potential for the migration of metals, emphasize a no action policy. Efficiency and experience of a cleanup are important criteria in selecting a remedial method, but cost effectiveness, and practicality are essential considerations to a small corporation, such as MACDERMID.

The RFI Work Plan (Task III) has been designed to provide a general outline of the site sampling program which is primarily focused on the verification of previous work done and data collected at the site. The Work Plan also is concerned with the acquisition of additional data to further



define and delineate SWMU boundaries. This new data would also be beneficial in defining more specifically related SWMU constituents for purposes of source identification and migration rate and/or pathways, or to verify the lack of migration.

A total of 16 soil borings have been recommended for continuous (2-foot long), split-spoon sampling using a hollow-stem auger rig. Nine soil borings will be advanced in the lagoon area (SWMU No. 1). These borings will be sampled for the following metals: chromium, copper, nickel, zinc, and lead. To further address the vertical extent of the organic contamination in the lagoon area, as well as the areal extent, soil borings in this SWMU area will be sampled for the following organic constituents: chlorobenzene, methylene chloride, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, ethylbenzene, toluene, xylenes (total), and bis(2-ethylhexyl) phthalate.

Three soil borings will be advanced in SWMU No. 2 in conjunction with the first incinerator location to determine the extent of metals contamination near the surface from the emissions of the incinerator at this first location. Metals analysis will include the following: chromium, copper, nickel, zinc, and lead. Borings advanced in this area will also be analyzed for possible metals' contamination that may have been associated with the original container storage area adjacent to the northwest corner of the building. The evaluation of contamination possibly related to the incinerator after it was moved to the second location, on the south side of the building will be conducted in conjunction with the investigation of the closed surface impoundment area (i.e. lagoon area/SWMU No. 1).

A minimum of four soil borings are also recommended in the railroad spur area (SWMU No. 3). These borings will be analyzed for metals (as listed above in SWMU Nos. 1 and 2) in an effort to determine the actual source by defining the extent and/or boundaries of contamination in this area.

Five 2-inch diameter, stainless steel monitor wells will be installed to approximately 15- to 20-feet deep on the site. Two of the wells will be installed in an upgradient location to provide the additional background data required by the MDNR (MW1 and MW2). The three downgradient wells will be helpful in determining local and seasonal ground-water gradient at the site. All five wells will be used for sampling ground water as needed, or on a scheduled basis (i.e., quarterly, monthly, etc.).

This RFI written for MACDERMID will abide by the RCRA Corrective Action Plan (CAP) Guidance (Interim Final), OSHWER Directive 9902.3. MACDERMID will submit and implement on a timely manner all draft/final reports and work plans as mentioned in this report.



**TASK 1**

**DESCRIPTION OF CURRENT CONDITIONS**

## 1.0 INTRODUCTION

The MacDermid Incorporated Ferndale, Michigan, manufacturing facility (hereinafter referred to as MACDERMID, or the site) is located approximately 7 miles northwest of the Detroit Metropolitan area (see Figure 1.1, Site Location Map). The site and surrounding properties are zoned as a general manufacturing district. To the west and southwest is a business district. A medium density residential area is located northwest of the site. Proprietary chemicals for metal finishing, electronics and microelectronics, plus surface preparations and finishings for metals, plastics, and other materials are manufactured at this facility. MACDERMID also recycles some chemical products that are returned by their customers for reclaiming.

MACDERMID is a Resource Conservation and Recovery Act (RCRA) transportation, treatment (recycle operation), and storage facility. Initially, the facility was operated under interim status (40 CFR 265) as an existing hazardous-waste management (HWM) facility. Since June 10, 1985, it had been operating under a RCRA Part A permit (40 CFR 270.13). On September 24, 1990, the facility's application for Part B permit status (40 CFR Part 270.14) was concurrently issued by the United States Environmental Protection Agency (USEPA) and the Michigan Department of Natural Resources (MDNR).

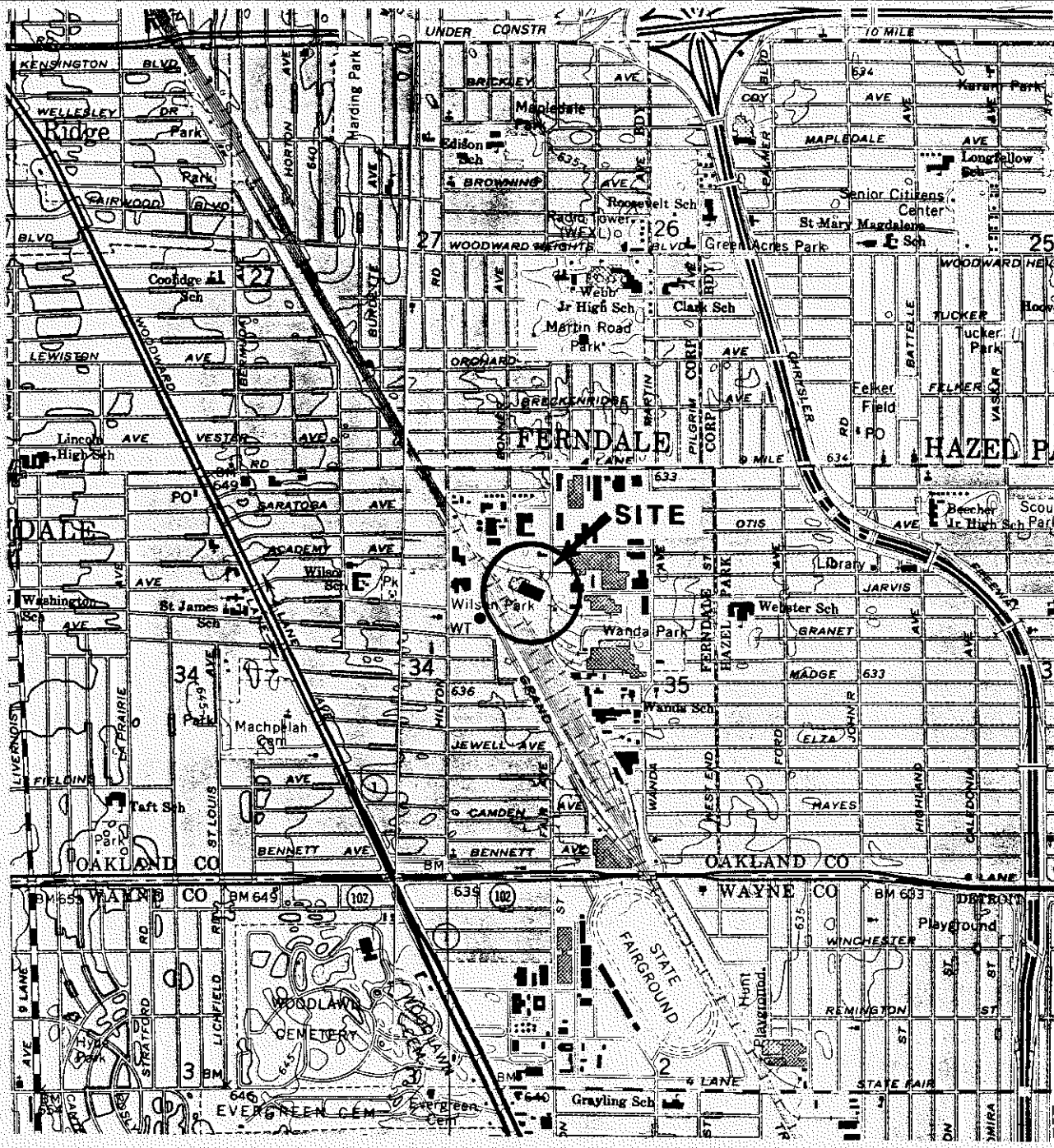
### 1.1 SCOPE OF THE RCRA FACILITY INVESTIGATION

Historical and current manufacturing processes and overall wastestream management have been determined by the USEPA and the MDNR to constitute a point of concern as to the past, present, or possible future release of hazardous wastes and constituents into the environment within the scope of Section 3008(h) of RCRA. As a result, USEPA and MACDERMID have entered into an agreement, as part of the Part B permit maintenance, to conduct a RCRA Facility Investigation (RFI) of the site.

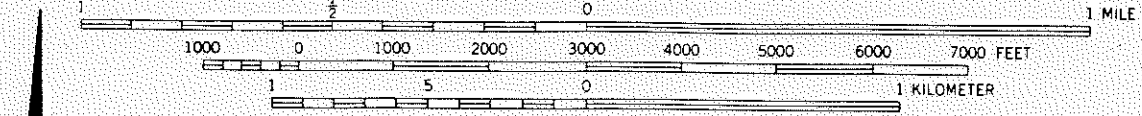
This RFI has been written with the prior knowledge that a sufficient amount of analytical and historical information is presently available on this site to conduct an extensive data review and provide an accurate characterization of the site during the pre-investigative tasks (i.e. Tasks I and II). Modification of Task III, concentrating sampling efforts on the three solid waste management units (SWMUs) outlined in the Part B permit, and any other suspected source areas of contamination, would also facilitate a more timely approach in the selection of suitable remediation schemes.



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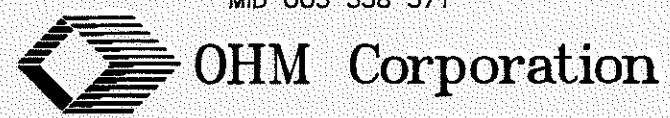
CONTOUR INTERVAL 5 FEET  
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FIGURE 1.1

SITE LOCATION MAP  
 MACDERMID, INCORPORATED  
 1221 FARROW AVENUE

PREPARED FOR

MACDERMID, INCORPORATED  
 FERDALE, MI 48220  
 MID 005 338 371



PLAT FROM U.S.G.S. QUADRANGLE  
 7.5 MINUTE SERIES  
 REVISED 1967  
 "HIGHLAND PARK" &  
 ROYAL OAK, MICHIGAN





(Task II) for this site. The ultimate goal of this investigation is focused on cleanup and/or control of the site-related constituents through a better understanding of the following:

- o The degree and extent of site constituents in the environmental media
- o The pathways of constituent migration from the site, as well as the potential impact of constituents on potential receptors
- o On-site physical features and facilities that could affect constituent migration

This three-task program consists of an initial investigative step (Task I) to determine the nature and extent of site-related constituents, potential pathways of constituent migration, and potential endangerment to public health and the environment from these site constituents. Task II will identify potential corrective measure technologies that may be used on site or off site for containment, treatment, remediation, and/or for the disposal of contaminants. The third task will include the Work Plan, outlining site sampling events for verification of previous work done and for the acquisition of additional data points pertinent to the three SWMUs specified in the Part B permit and any other areas of concern. This sampling plan will also reinforce or discredit recommendations being considered for remediation (Task II). The draft and final report will present and interpret the data analyzed in Tasks I and II, and the results acquired during the sampling phase of the Final Work Plan (first part of Task III) which will provide a sufficient basis for a determination of endangerment to human health and the environment and the identification and evaluation of remedial action alternatives at the site.

## 1.2 FACILITY BACKGROUND

The MACDERMID, Ferndale, Michigan, plant has been in operation for over 23 years (foundation borings June 2, 1966).

The property is bounded on the north, east, and west sides by industrial and commercial properties (see Figure 1.2, Site Plan Map). The south side of the property is bounded by the Grand Trunk and Western Railroad yard. One main building covers approximately 76,000 square feet (approximately 27 percent) of the property and houses the manufacturing/storage facility and the company offices.

DRAWING 9961A1-2(FIG1-2)  
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PLAT SCALE: 1" = 1"

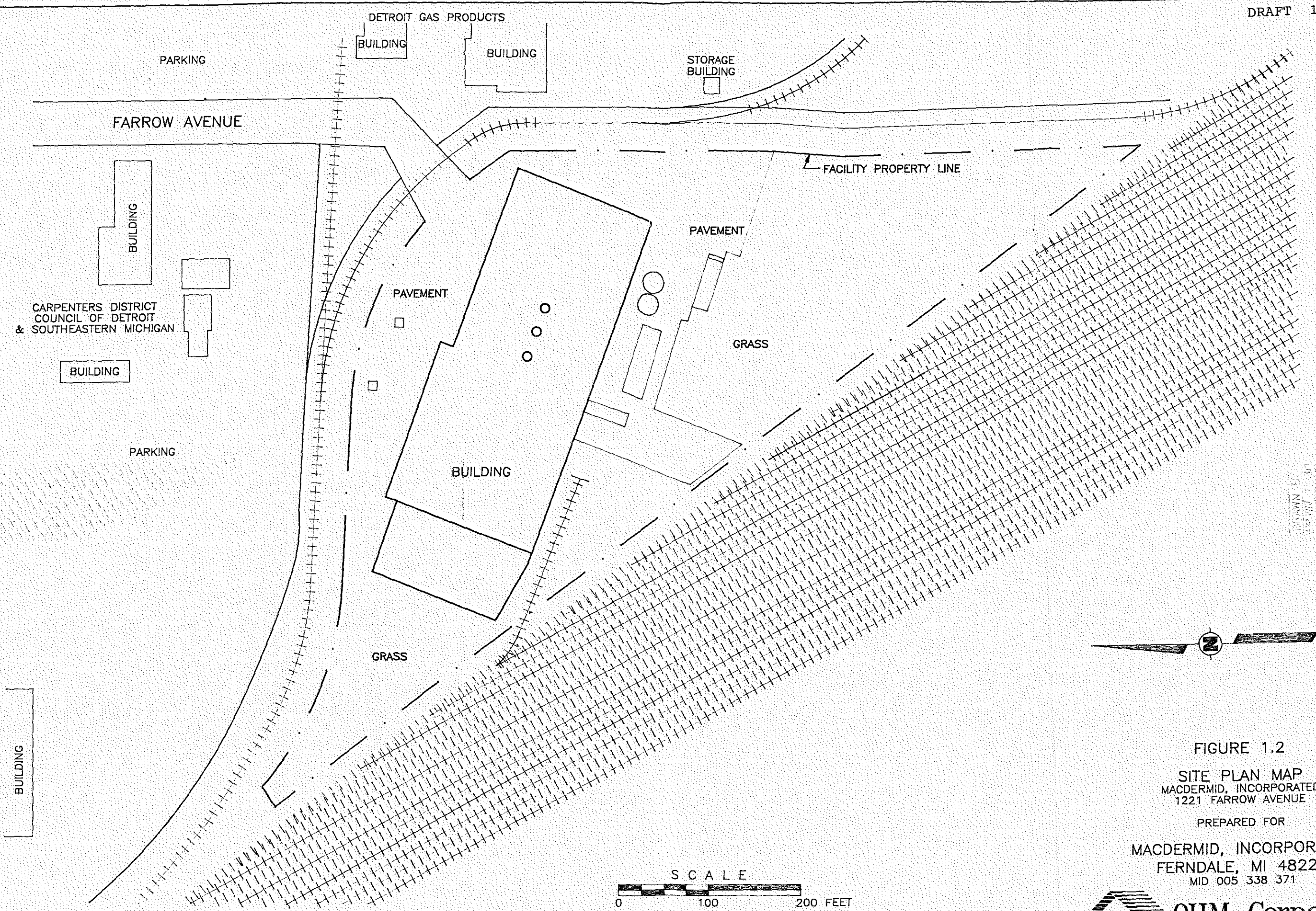
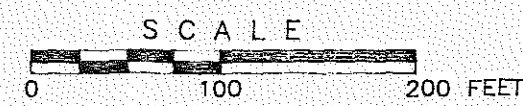
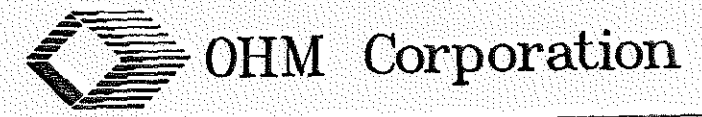


FIGURE 1.2

SITE PLAN MAP  
MACDERMID, INCORPORATED  
1221 FARROW AVENUE

PREPARED FOR

MACDERMID, INCORPORATED  
FERNDAL, MI 48220  
MID 005 338 371



This facility is designed to store up to 47,520 gallons of hazardous waste in containers (55-gallon drums, 330-gallon totes, and 13-gallon carboys) generated by off-site facilities. There is presently one (temporary) hazardous-waste storage area located under the mezzanine of the liquids department (see Figure 1.3). This area has a 12,000-gallon capacity for storage of hazardous wastes. A concrete containment with a sealant covers and surrounds the area. Floor drains are plumbed into the facility wastewater-treatment system.

An upgraded hazardous-waste storage area is proposed on the south-central side of the building. The new storage area will have adequate secondary containment and provide an additional 35,520 gallons of hazardous-waste storage area. The top concrete (surface) will be sealed with a resin coating (Cielcrete 695) that is resistant to the stored wastes. A 60 millimeter thick synthetic liner (Gundline) will be laid between the top concrete layers and the foundation concrete layers to prevent any leakage due to breakthrough of the top concrete into the soils and ground water. The upgraded storage area will be constructed upon approval of the engineering plans and specifications by the Waste Management Division of the MDNR. This information was stated in the Fact Sheet for the Proposed State Operating License and Federal Permit, under Description of the Facility Section II, C-2.

MACDERMID has manufactured approximately 1,800 new products at the Ferndale facility. Some of these products have been discontinued or are presently in an inactive mode. Over 464 different chemicals are used in the manufacturing and recycling processes at this facility (see Appendix A for a list of chemicals and a list of raw materials).



DRAWING 9961A1-4(FIG1-3)  
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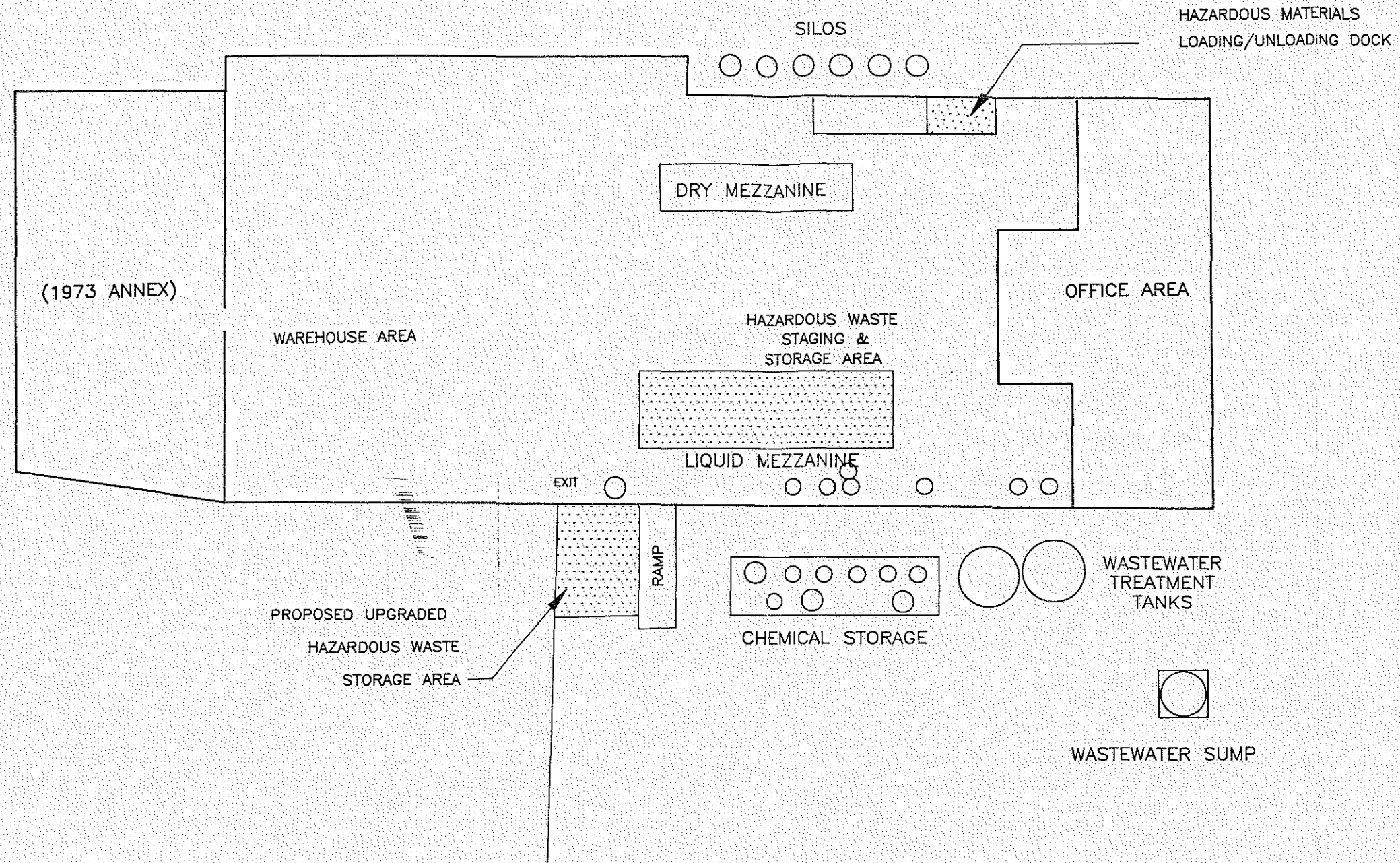
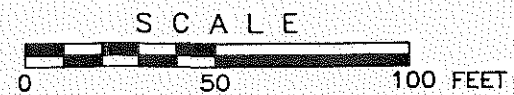


FIGURE 1.3  
HAZARDOUS WASTE AREAS  
MACDERMID, INCORPORATED  
1221 FARROW AVENUE

PREPARED FOR

MACDERMID, INCORPORATED  
FERNDAL, MI 48220  
MID 005338371

 OHM Corporation



## 2.0 GEOLOGY AND HYDROGEOLOGY

The following summarizes regional and site geological and hydrogeological conditions.

### 2.1 REGIONAL GEOLOGY

The city of Ferndale is located in the southeast corner of Oakland County. It is in the Pleistocene glacial lake plain physiographic province which is essentially composed of finely textured, low permeability, unsorted till/drift. Northeast-southwest trending depositional environments varied from waterlaid moraines northwest of the site to lacustrine deposits of sandy and clayey sediments on site. The overall thickness of the drift/till in the glacial lake plain is less than 150 feet.

Prior to glaciation, this area was part of the Erie-Huron Upland physiographic region. The Antrim Shale, a dark brown to black shale of late Devonian age, subcrops directly beneath the glacial drift/till. This missing stratigraphic section is due to a period of subareal erosion which removed all post-Paleozoic sediments over the entire state of Michigan. Local remnants of the Bedford Shale, Berea Sandstone, and Coldwater Shale of Mississippian-Devonian and early Mississippian Age, respectively, are also present in this area. Differentiation of these bedrock members in the subsurface is difficult because they all consist of varying degrees of blue to light gray shales.

Regional dip is to the north-northwest due to the structural influence of the major basin-like feature to the northwest, in central Michigan. The average rate of dip in the southeast portion of Oakland County is 40 feet per mile. Bedrock is approximately 550-feet below ground surface.

### 2.2 SITE GEOLOGY

In the less highly urbanized sections of this area, where the native surface soils have not been altered by construction, the Thetford soil unit still exists. Undisturbed, this unit should have a thickness of approximately 3.5 feet. At the surface and down to a depth of 1.5 feet, the Thetford consists of loamy, fine sand. From 1.5 to 3.5 feet the subsoil is composed of a loose, fine sand with thin discontinuous bands of friable loamy sand. In the substratum, the Thetford becomes a calcareous fine sand.

Locally, beneath the Thetford soils, sand and clay fill material is described from 4- to 6-feet deep in borings advanced previously at the site. Underlying the fill material are sandy, silty, oxidized yellow-brown clays. Stiff, moist blue clay was encountered at a depth of 7 feet in the north-



east part of the site, ranging to 13.25-feet deep across the remaining portion of the property. This clay is estimated to be 60- to 70-feet thick from previously reported data in the area (IPC Report, April 1987).

### 2.3 REGIONAL HYDROGEOLOGY

Ground water associated with the glacial lake plain province is found in both confined and unconfined conditions. This is due to the variable nature of the sedimentation in the drift/till. Scattered, limited-extent, surface and near surface deposits of coarse clastics represent the unconfined or perched water table conditions.

Confined conditions refer to aquifers in the sand and gravel lenses, pods and pockets that have been deposited simultaneously with the clays, and other low permeability materials in the drift/till. These aquifers, due to their limited thickness and vertical extent, normally provide small to moderate quantities of water in this glacial lake plain area. Confining layers may only be partially impermeable, allowing for infiltration from unknown sources that cannot be accurately traced in this variable subsurface.

Ground-water yields in the lake plain sediments range from a low of 0.2 gallons per minute (gpm), to a high of 1,500 gpm (averaging 102 gpm). This is due in part, to the variability in the water-yielding properties, such as specific capacity (0.03 to 164.4 gpm per foot.) and amount of drawdown in these sand and gravel lenses. In a study of well yields done by Leverett in 1906 to 1907 (Occasional Papers on the Geology of Michigan for 1954, part II, Geological Survey Division, 1954, pp. 344.), the available producing wells showed the following yields:

- o 72 percent of the wells yielded less than 21 gpm
- o 13 percent of the wells yielded 21 to 100 gpm
- o 8 percent of the wells yielded 101 to 500 gpm
- o 7 percent of the wells yielded 500 to 1,500 gpm

Well diameters, depth of the well, and length of screened interval(s) also contribute to additional variables in these yield rates. From this data it was determined that for a 6-inch diameter well, the average yield was 10 gpm. Today these aquifers may be in various states of depletion due to the demands placed on them in the earlier stages of urbanization in this area. The shallow, unconfined aquifers are no longer used for human consumption in these highly urbanized areas.

Aquifers in the bedrock in this area have generally proven to be of low volume and poor quality. Mineralization of the water causes it to be undesirable for industrial use.

#### 2.4 SITE HYDROGEOLOGY

The eastern part of Oakland County is drained by the Clinton River. Locally saturated conditions in the soil have been a major problem associated with both the surface and subsurface soils at the site. This is especially prominent in the seasonably higher water table found in the area. Approximately level surface topography, plus the amount of clay intermixed in the near surface and subsurface soils, may deter run-off and cause ponding in some areas. Prior to construction of the facility in mid-1966, topography was limited to a low marshy area in the central portion of the property. A recent survey of the site (see Figure 2.1, Site Topographic Map) shows topographic gradient and surface drainage to the east-southeast.

The presence of an intricately semi-connected and generally unpredictable perched water table in the upper few feet of soil was noted on the logs advanced on the site during two environmental investigations conducted by Techna in 1989 (Techna Reports: January 1989 and April 1989). Saturated soils were encountered from 8- to 13-feet below ground level, just above the blue clay layer. This accumulation of ground water may be due to the confining or sealing nature of the clays, discouraging additional ground-water percolation. This source of ground water represents the deepest perched/unconfined aquifer in the area. Low yielding zones of ground water are associated with limited fracture and microfracture systems within the blue clay and/or the associated sand lenses and pods found sporadically deposited in the clay.

DRAWING 9961A1-2(FIG2-1)  
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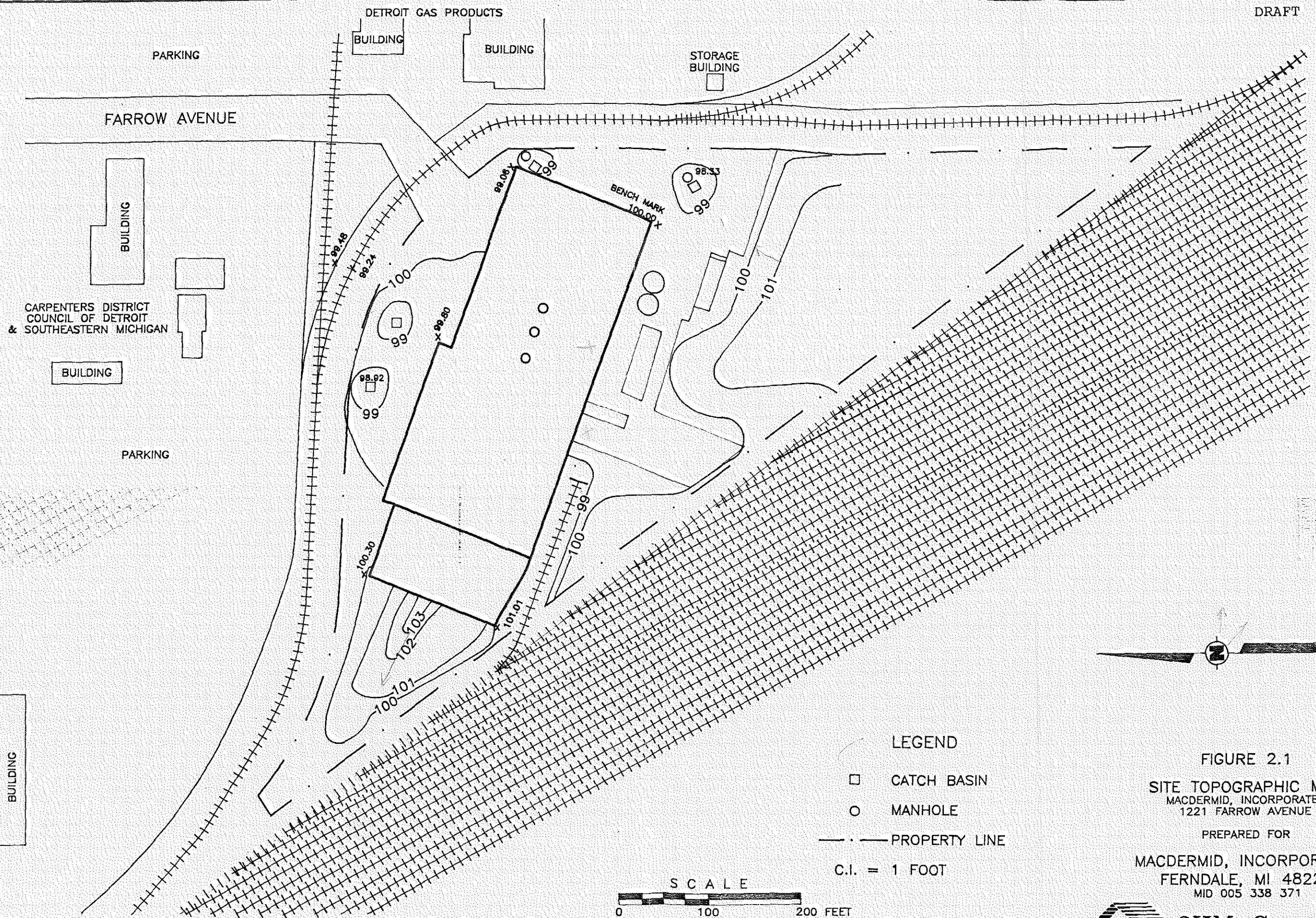
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C.E. MERRIN 1-30-91

OHM CORPORATION  
FINDLAY, OHIO

PLOT SCALE 1" = 1'



LEGEND

□ CATCH BASIN

○ MANHOLE

--- PROPERTY LINE

C.I. = 1 FOOT

SCALE

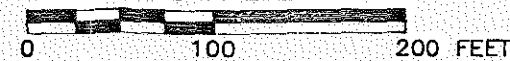


FIGURE 2.1

SITE TOPOGRAPHIC MAP  
MACDERMID, INCORPORATED  
1221 FARROW AVENUE

PREPARED FOR

MACDERMID, INCORPORATED  
FERNDAL, MI 48220  
MID 005 338 371



### 3.0 PERMITS

The MACDERMID Ferndale facility operated originally under interim status. The application for a RCRA Part A Permit was submitted to the USEPA in 1983. It was amended and submitted to MDNR on June 10, 1985. The facility's Part B Permit application was issued by the USEPA in conjunction with the MDNR on November 11, 1988. The facility's Part B Permit No. is MID 005 338 371 (copy upon request).

On the basis that all present hazardous-waste handling activities at the storage facility are conducted inside the structure of the building and in areas of satisfactory secondary containment, spills and/or leaks can be contained and properly remediated. There should be no potential for contaminated run off because all of the hazardous-waste activities presently take place inside the MACDERMID manufacturing building.

This information brings into focus the explanation for MDNR's waivers concerning ground-water monitoring requirements [R299.9611(3)], a hydrogeology report waiver [R299.9508(2)], a ground-water waiver [R299.9506(7)], and a soil monitoring waiver [R299.9506(7)]. The ground-water monitoring requirements are waived because all hazardous-waste activities take place inside the facility building where they are protected from the weather, precipitation, and run off, and hazardous-waste areas have secondary containment to prevent spills and/or leaks. The waivers concerning the hydrogeology report, ground-water monitoring, and soil monitoring all address the same points given above, plus a third summation point, that spills and/or leaks will not contact unprotected soils.

MACDERMID has been in compliance with the MDNR's Act 348 due to the fact that all containers (drums, etc.) of hazardous waste are inspected daily and the containers are handled inside the building in secondary containment areas. Therefore, MACDERMID has not had to monitor ambient air or conduct annual soil monitoring.

Permits involving specialized plant processes and/or operations includes MACDERMID's Air Use Permit issued by the MDNR Air Quality Division (No. 614-86) (see Appendix B). This permit was originally issued on August 27, 1986, to address the eight scrubbers in use at that time. This permit was voided and a new Air Use Permit to Install (No. 614-86A) (see Appendix B) was issued to MACDERMID on September 22, 1989, by the MDNR Air Quality Division to accommodate the addition of five new scrubbers into the system, making a total of 13 scrubbers. At the present time, MACDERMID has removed the two 1,000 cfm Niehaus scrubbers and the one 500 cfm Duall scrubber which were on the Dry Bulk Silos.

These three scrubbers were replaced with a 2,000 cfm Duall scrubber. The MDNR Air Quality Division has been notified of this recent change.

This facility operates its own wastewater-treatment system which discharges treated liquids into the city of Detroit's combination storm/sanitary sewer. The facility is authorized to discharge this industrial wastewater to the city sewer according to their Industrial Wastewater Discharge Permit No. 009-025 (see Appendix B). This permit was issued by the Detroit Water and Sewerage Department (DWSD). The renewal of this permit was granted in accordance with the original application filed in the office of the DWSD. The permit contains specific discharge limitations, as well as selfmonitoring and reporting requirements for the facility.

In the past, MACDERMID burned most of their cardboard drums and trash in an incinerator that was originally located just off of the northwest corner of the main building, prior to the construction of the annex in 1973. The history of this incinerator can be traced back to June 27, 1967, from the construction date given on the September 12, 1973, Incinerator Permit No. 89-73I (see Appendix B). This permit was required for the notification of equipment alteration. The permit was issued by the Michigan Department of Health Air Pollution Control Commission. In 1973 the incinerator was moved to the south-central side of the property, however, no notification of this relocation was available (verbal: MACDERMID and Oakland Planning Commission Aerial Photos 1980 and 1985). The incinerator was dismantled on August 3, 1981, and removed and a trash compactor was purchased. On June 27, 1988, the permit for the incinerator was voided.



#### 4.0 FACILITY IMPROVEMENTS

This section describes the upgrades and improvements made at the MACDERMID facility to provide for increased protection of public health and the environment during the handling, storage, and treatment of hazardous materials.

##### 4.1 WASTEWATER-TREATMENT SYSTEM

MACDERMID's Ferndale, Michigan, facility's wastewater-treatment system is designed to capture contaminants from the process, recycle, reclamation, and manufacturing wastestreams. The installation of the current treatment system was in response to "Stricter Requirements", by the MDNR and the city of Ferndale (see lagoon history, Section 5.1) in 1982 in which surface impoundment lagoons were decommissioned. The city of Ferndale was involved in the decommissioning of both sludge lagoons, the MDNR was not. The wastewater-treatment system was designed to process heavy metal sludges generated from the plant's manufacturing and recycling operations.

##### 4.1.1 Permit Condition Requirements

The facility's Industrial Wastewater Discharge Permit (No. 009-025) was issued by the Detroit Water and Sewerage Department (DWSD). It was granted in accordance with the application filed in the office of the DWSD and became effective September 1, 1990. The permit contains specific discharge limitations and self-monitoring and reporting requirements for the facility (see Industrial Wastewater Discharge Permit, Appendix B).

The Ferndale facility is authorized to discharge industrial wastewater to the city of Detroit sewer in compliance with the city's Wastewater Discharge Ordinance and provisions of federal or state law.

##### 4.1.1.1 Effluent Limitations

The pretreatment effluent discharge results are summarized in Table 4.1. These samples were collected and analyzed by the DWSD and represent the facility's wastewater-treatment system effluent discharge analytical profile. The data suggests that the Ferndale facility's wastewater pretreatment system is in compliance with their Industrial Wastewater Discharge Permit (No. 009-025), and that the results are below maximum allowable limits for the analytes tested.

**TABLE 4.1**

**PRETREATMENT ANALYSIS – DWSD – DISCHARGE CONSTITUENTS**  
**Detroit Water & Sewer Department**  
**(mg/l)**

Sample ID # (DWSD)	Location	Matrix	Sample Date	Cd	Cu	CN	Pb	Ni	Cr	Zn	P	Fats, Oil, & Grease (FOG)	Total Suspended Solids	Biochemical Oxygen Demand	pH
90008577	MH #1	Liq	11/01/90	<0.01	0.17		<0.12	0.92	0.25	1.35	0.71		24.00	56.00	
90008578	MH #2	Liq	11/01/90	<0.01	0.16		<0.12	0.77	0.23	1.10	0.85		40.00	>148.00	
90008579	MH #1	Liq	10/31/90			<0.02						9.40			8.6
90008580	MH #2	Liq	10/31/90			<0.02						66.60			8.8
90007924	MH #1	Liq	10/12/90	<0.01	0.07		<0.12	0.80	0.09	0.16	0.82		13.00	51.00	
90007925	MH #2	Liq	10/12/90	<0.01	<0.02		<0.12	0.88	0.12	0.23	1.11		<10.00	70.00	
90007926	MH #1	Liq	10/11/90			0.02						13.40			9.2
90007927	MH #2	Liq	10/11/90			0.03						<5.00			9.1
90007960	MH #2	Liq	10/10/90	<0.01	0.24		<0.12	1.73	0.14	0.97	0.07		<10.00	74.00	
90007959	MH #1	Liq	10/10/90	<0.01	0.18		<0.12	1.00	0.07	0.55	0.29		<10.00	36.00	
90007961	MH #1	Liq	10/09/90			<0.021						<5.00			8.7
90007962	MH #2	Liq	10/09/90			<0.02						<5.00			7.7
90001240	MH #1	Liq	03/06/90			<0.02						88.50			7.8
90001241	MH #2	Liq	03/06/90			<0.02						7.10			7.7

MH #1 = Man Hole #1 – located 20 ' East from East wall of building,  
10 ' from telephone pole wing by the East fence in parking area

MH #2 = Man Hole #2 – located 5 ' South of the South building wall  
between the waste tanks

#### 4.1.1.2 Monitoring Requirements

The monitoring requirements for the facility's wastewater-treatment system is outlined in their Industrial Wastewater Discharge Permit (No. 009-025). In order to comply with their permit requirements, the Ferndale facility performs weekly analytical testing on its wastewater treatment effluent and records results before final discharge.

#### 4.1.1.3 Wastewater Analysis

The analytical results on pretreatment effluent samples are presented in Appendix C. These results represent the facility's weekly monitoring program and is a requirement for compliance with their discharge permit.

#### 4.1.2 Treatment System Design

The upgraded treatment system consists of a 4,000-gallon wastewater collection sump, two 34,000-gallon wastewater pretreatment tanks, and a filter press for dewatering. MACDERMID's current treatment scheme involves chemical precipitation, clarification/settling, and sludge dewatering processes. The primary purpose of the system is to treat and remove metal-containing wastes and minimize the volume of hazardous waste generated for off-site disposal.

#### 4.1.3 Chemical Pretreatment

The chemical precipitation process best describes the method of treatment. The treatment process is constructed and operated in a manner that prevents the release of any hazardous waste or any constituents into the environment during treatment operation. The hazardous-waste residuals collected from the facility drains, as a result of the management of hazardous waste, are piped through the industrial wastewater-treatment sewer to the wastewater collection sump for pretreatment. It is then treated and discharged to the publicly-owned treatment works (POTW) in accordance with the facility's Industrial Discharge Permit (No. 009-025).

##### 4.1.3.1 Chromium Reduction

If hexavalent chromium is present, the precipitation process is accomplished by first adding sodium hydrosulfite or sodium sulfite to reduce the oxidation state. This is followed by pH adjustment with caustic soda/lime and the addition of an polyelectrolyte solution to enhance flocculation. After sufficient settling time, the supernatant is discharged to the POTW in compliance with the facility's permit.

#### 4.1.3.2 Heavy Metal Precipitation

Heavy metals are removed by chemical precipitation that involves an initial pH adjustment with caustic soda/lime and the addition of an polyelectrolyte to enhance flocculation and improve solid settling rates. After flocculation and solids settling have been achieved, the effluent is discharged into the sanitary sewer for treatment by the POTW.

#### 4.1.3.3 Wastewater-Treatment Process Flow Diagram

The facility process flow diagram for the wastewater-treatment system is presented in Figure 4.1. The diagram represents the facility's management activities of hazardous waste and includes all entry and exit points for materials that are handled and processed at the manufacturing facility.

#### 4.1.4 Filter Press Operation

Hazardous-waste sludge generated by the pretreatment process is dewatered according to the flow diagram shown in Figure 4.2. The underflow is pumped into the filter press where the sludge is dewatered, dropped, and collected for disposal. The dry filter cake is then transported to a regulated landfill in compliance to the facility's Industrial Wastewater Discharge Permit.

##### 4.1.4.1 Characterization and Disposal

The hazardous-waste sludge generated from the filter press operation is characterized before shipping and disposal. The waste sludge analytical composition must be below specific regulatory limits set by the MDNR.

EP toxicity parameters have been analyzed on leachate samples collected from the facility's waste sludge until recently when the TCLP analysis replaced the EP-toxicity method. Results of these analyses are summarized in Table 4.2. These results represent the toxic chemical composition of the sludge and are used to characterize the waste.

##### 4.1.4.2 Waste Analysis

TCLP and EP-TOX results obtained from sludge samples are presented in Appendix D. These analytical results are used to characterize the waste sludge before stabilization and disposal at a licensed facility.

#### 4.1.5 Facility Drainage System

The facility structure is a steel frame building with insulated metal roof and siding panels. Floor drains in the



PLOT SCALE: 1" = 1"

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FINDLAY, OHIO

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NUMBER 9961-A1

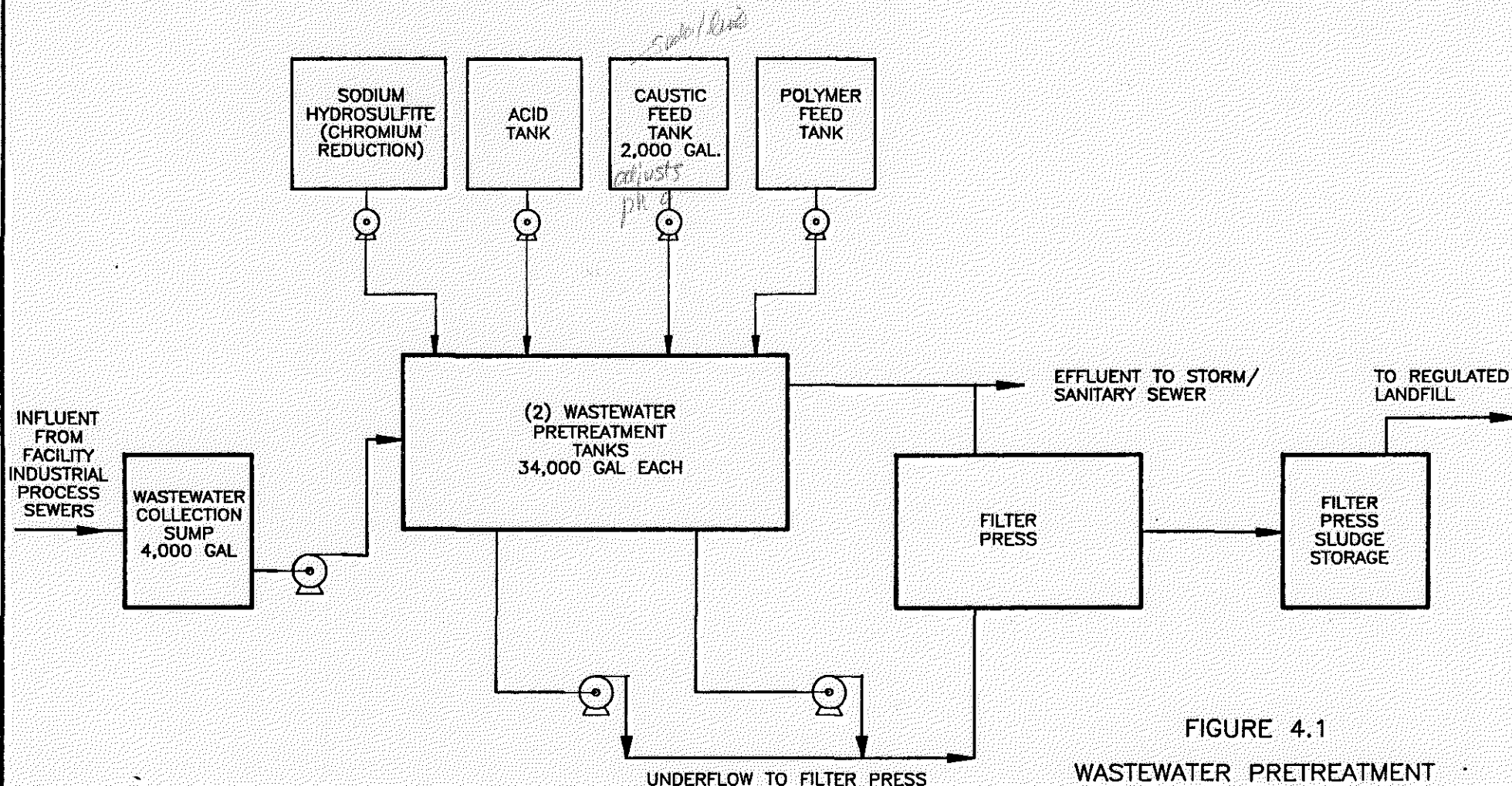


FIGURE 4.1

WASTEWATER PRETREATMENT  
PROCESS FLOW DIAGRAM  
MACDERMID, INCORPORATED  
1221 FARROW AVENUE

PREPARED FOR  
MACDERMID, INCORPORATED  
FERNDAL, MI 48220

MID 005 338 371



OHM Corporation

DRAFT 4-5

PLOT SCALE: 1" = 1"

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FINDLAY, OHIO

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DRAWING NUMBER 9961-A2

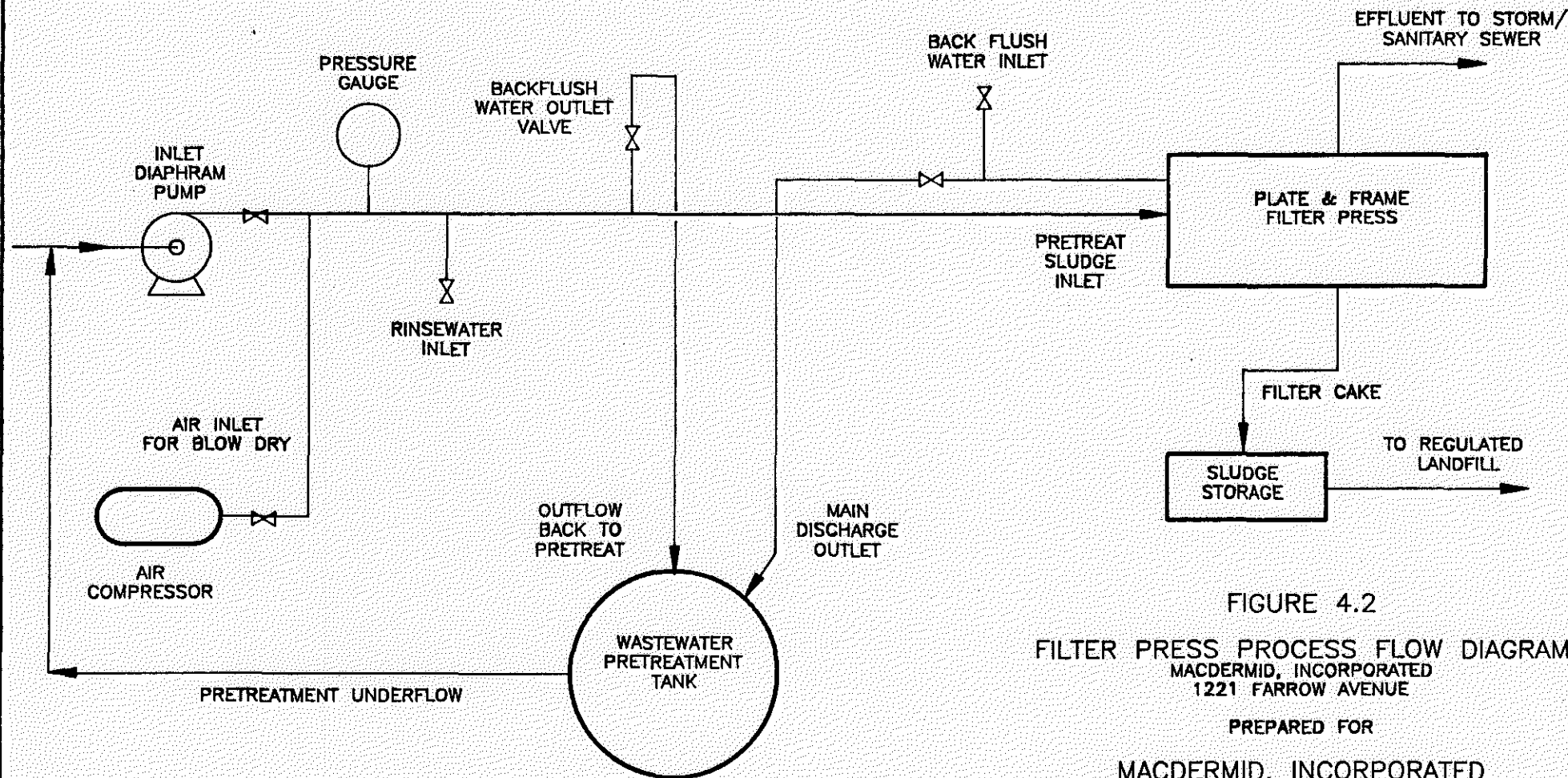


FIGURE 4.2

FILTER PRESS PROCESS FLOW DIAGRAM  
MACDERMID, INCORPORATED  
1221 FARROW AVENUE

PREPARED FOR

MACDERMID, INCORPORATED  
FERNDAL, MI 48220  
MD 005 338 371



OHM Corporation

DRAFT 4-6

TABLE 4.2

**FILTER PRESS SLUDGE – WASTE DISPOSAL ANALYSES – TCLP RESULTS  
(mg/l)**

SAMPLE ID #	ANALYSIS DATE	MATRIX	LOCATION	PARAMETER													
				As	Ba	Cd	Cr (Total)	Cu	Pb	Hg	Ag	Se	Zn	Ignitability	Cyanide (reactive)	Sulfide (Reactive)	pH
Sludge	09/06/90	Solid	Filter Press	<0.05	<0.10	<0.10	1.17	1.70	0.278	<0.010	0.107	<0.05	1.79	> 212 deg F	<1.0 mg/250kg	<10 mg/500kg	7.93
Sludge	10/10/89	Solid	Filter Press	0.01	0.50	0.50	0.50	0.50	0.50	0.00	0.50	0.01	0.50	> 212 deg F	<1.0 mg/kg	<10 mg/kg	9.00
Sludge	11/16/88	Solid	Filter Press	<0.003	<0.50	<0.50	3.04	1.70	1.01	<0.001	<0.50	<0.01	2.30	> 212 deg F	<1.0 mg/500kg	<10 mg/500kg	8.50
Sludge	06/01/88	Solid	Filter Press											> 212 deg F	<1.0 mg/250kg	<10 mg/500kg	8.75

DRAFT 4-7

slab drain to the facility's 4,000-gallon Fiberglass waste-water sump that is contained in a 10-inch thick concrete vault with a chemically resistant coating on the concrete. Wastes collected in the sump are pumped to the wastewater pretreatment tanks that provide treatment before the effluent is discharged to the city of Detroit's sanitary sewer system in accordance with the facility's Industrial Wastewater Permit (No. 009-025).

#### 4.1.5.1 Mezzanine Drainage (Liquid and Dry Production Areas)

The mezzanine is a raised platform in the manufacturing area. It provides access to the blending and formulating equipment used to produce specialty chemicals, which are used in the metal finishing, microelectronics, and surface finishing industry. The drains associated with these areas collect residuals resulting from the management of hazardous waste into sumps that drain into the mezzanine wastewater sewer (see Appendix E). This process waste sewer is piped to the facility's industrial wastewater sewer and transports contents to the collection sump for pretreatment and discharge in accordance with their Industrial Wastewater Permit (No. 009-025).

#### 4.1.6 Hazardous-Waste Staging and Storage Area

The container storage and staging area is used for the storage of drums and small containers of hazardous waste prior to transportation. Hazardous-waste materials stored in this area include corrosives and alkaline materials containing toxic metals generated from the manufacture of specialty chemicals and the receiving of recyclable materials.

The drains located in these areas collect residual contaminants resulting from the on-site management of hazardous-waste materials. The drains are connected to the facility's industrial wastewater sewer and transfer the contents to the wastewater sump for pretreatment and discharge to the POTW.

The floor trenches and drains in the manufacturing area and storage area drain to the Ferndale facility's industrial pretreatment system for processing. After pretreatment the effluent is discharged to the sanitary sewers in accordance with their Industrial Wastewater Discharge Permit (No. 009-025).

#### 4.1.7 New Drum Wash Area

The new drum wash area is located south of the liquid mezzanine in the manufacturing process area. The floor drains collect and transport residuals from management activities to the facility's wastewater collection sump. After pretreatment the effluent is discharged to the sanitary sewer.



#### 4.1.8 Office Area

The office area is located on the northeast side of the building. The sewage from the office area is piped directly to the sanitary sewer system in a separate line.

#### 4.1.9 Chemical Storage and Tankfarm Area

The chemical storage and tank farm area is located at the south center corner of the building. The bulk chemicals stored in this area are used in the processing, manufacturing, and reclamation activities conducted at the facility.

The drain located in this area is piped to the wastewater-treatment system for pretreatment, then discharged into the combination storm/sanitary sewer in accordance with their Industrial Wastewater Discharge Permit (No. 009-025).

#### 4.1.10 Proposed Upgraded Hazardous-Waste Storage Area

The proposed upgraded hazardous-waste storage area will have adequate secondary containment. The top concrete surface will be sealed with a resin coating that is resistant to the wastes stored. There is currently no provisions for process drains to be located in this area.

#### 4.1.11 Laboratory Area

The facility's on-site laboratory drains into the industrial wastewater sewer. The industrial waste pipeline discharges into the collection sump for pretreatment before being discharged to the sanitary sewers in accordance with Industrial Wastewater Discharge Permit (No. 009-025).

#### 4.1.12 Surface Run-off

The surface drainage on the north and east sides of the facility is collected in catchbasins and piped off site to the storm drain sewer system. The surface drainage on the south and west sides of the facility is collected and treated by the wastewater pretreatment tanks before it is discharged to the sanitary sewer system.

#### 4.1.13 Emissions

OHM does not currently have sufficient data to estimate possible fugitive emissions of volatile organics from the wastewater collection and treatment system. This wastewater is generated primarily from tank washing and drum washing activities. It will be necessary to collect wastewater samples from the collection and treatment system under conditions of normal operation in order to assess this possible source.

#### 4.2 WASTE MINIMIZATION PROGRAM

The primary waste minimization operation at the MACDERMID Ferndale manufacturing plant started at the facility's wastewater-treatment system as addressed in detail above in Section 4.1. The termination of the lagoons/surface impoundments was a major facility improvement in the overall effort to protect human health and the environment. Beyond this initial benefit is the reduction in the amount of waste generated and hauled off site to a land disposal facility. The filter press on the wastewater-treatment system reduces most of the solid waste in the overall plant wastestream, and the filter press associated with the two recycle tanks (Nos. 14 and 15) reduces volume of particulates and films generated during the recycle process.

The recycling process represents a considerable reduction in the generation of hazardous-waste material not only for MACDERMID but for their customers as well. At the Ferndale facility solder conditioners are recycled. This wastestream contains toxic levels of chromium, lead, and copper in a corrosive, acidic solution.

In March 1981, MACDERMID filled out an internal request to purchase and install a 1/2 cubic yard McClain trash compactor. This request was approved. On August 3, 1981, another internal request was made to provide labor for the dismantling of the old incinerator. This too was a major step in the goal of protecting human health and the environment by eliminating the possibilities of air contaminant emissions.

#### 4.3 SCRUBBER UNITS

It has been MACDERMID's policy throughout the life of the operation at Ferndale to be continually improving and expanding the fume and particle scrubbers in conjunction with the increase in emission contaminants due to the normal expansion of the manufacturing and recycling products' demand. The initial scaling-up of the system came in 1989 when five additional scrubbers were added, to make a total of 13 scrubbers. Continual upgrades and maintenance (new packing in the 6,000 CFM Duall No. 3) to these scrubbers is handled in-house. Daily and weekly routine checks are made on these units to ensure the continued efficiency rate.

#### 4.4 SECONDARY CONTAINMENT AREAS

The areas concerned with the protection of secondary containment are: the hazardous-waste staging and storage area under the liquid mezzanine, the hazardous-waste loading and unloading area, the proposed upgraded hazardous-waste storage area, bulk liquid storage tank area, and the sump (see Figure 1.3). All of these areas contain a minimum of a

concrete base coated with a sealant to prevent any leaks caused by breakthroughs in the concrete. This sealant also acts as a chemically resistant coating to prevent the possibility of reaction with the hazardous material if it came in contact with unprotected concrete.

The upgraded hazardous-waste storage area will have a liner between the bottom and top layers of concrete. The liner will be a 60-milliliter thick synthetic Gundline. The surface of the top concrete will be sealed with a resin coating that is resistant to the stored wastes.

#### 4.5 DRUM WASH AREA

As of May 1988, the drum wash area was moved inside the manufacturing building where all wash and rinse water goes to a drain that is part of the facility wastewater-treatment system. Prior to this, drum/container washing took place outside at the south center slab/concrete ramped area off the main building. Evidence of this wash area can be seen in the 1980 and 1985 aerial photos provided by the Oakland County Planning Commission. From these photos a stream of liquid can be seen running away from the building at this point. Constituent concentrations analyzed in the soils from SWMU No. 3 (Railroad Spur) which is directly west of this area may be related to this activity.

#### 4.6 INDOOR PROCESS AND OPERATIONS

Currently there is no known handling of hazardous waste outside the building structure, other than the sump which is covered by a roof to avoid natural precipitation and the two wastewater-treatment tanks that are open to the air at the top of each tank. The bulk liquid storage tank area is located outside along the southside of the building. All of these tanks are closed. There are nine tanks in this area: two regular steel tanks, one fiberglass tank, and five mild steel tanks. Secondary concrete containment, diking, and concrete sealant provides confinement for this area. Drainage from this area goes to the facility wastewater-treatment system.

## 5.0 NATURE AND EXTENT OF CONTAMINATION

MACDERMID owns and operates the facility at 1221 Farrow Avenue, Ferndale, Michigan. Located within the property are three solid waste management units (SWMUs) (see Figure 5.1, SWMU Location Map). Two of the three units are presently inactive: the two closed surface impoundments (SWMU No. 1) and the abandoned railroad spur (SWMU No. 3). SWMU No. 2, units that emit air contaminants, includes active as well as inactive processes where ventilation to the atmosphere is necessary. All three SWMUs have been used to handle non-hazardous wastes however, some hazardous wastes associated with the manufacturing wastestreams generated during the early life of the facility (1966 through early 1980s) were also handled.

An extensive list of chemicals used on site (Appendix A); a raw materials list (Appendix A); a MACDERMID products list (available upon request at the facility) with a basic knowledge of the manufacturing processes; and the waste analysis plan and wastestream descriptions and characterization parameters from the Part B permit (see Appendix F) were all documents used to determine product and waste constituents associated with MACDERMID's manufacturing processes. Previous analytical data collected from soil boring investigations and monitor well installation, gauging, and sampling were also reviewed to confirm and possibly further identify all Appendix VIII "Hazardous Constituents" that could be present in the MACDERMID waste at any given time during the life of the operating facility.

### 5.1 SWMU NO. 1, TWO CLOSED SURFACE IMPOUNDMENTS

The two closed surface impoundments (also referred to as Lagoon Nos. 1 and 2) are located adjacent to each other on the southeast side of the facility (see Figure 5.2, Lagoon Locations). Both impoundments have been filled-in using soil from the site and clean fill material that was hauled to the site. The closed impoundment area is presently semi-grass covered.

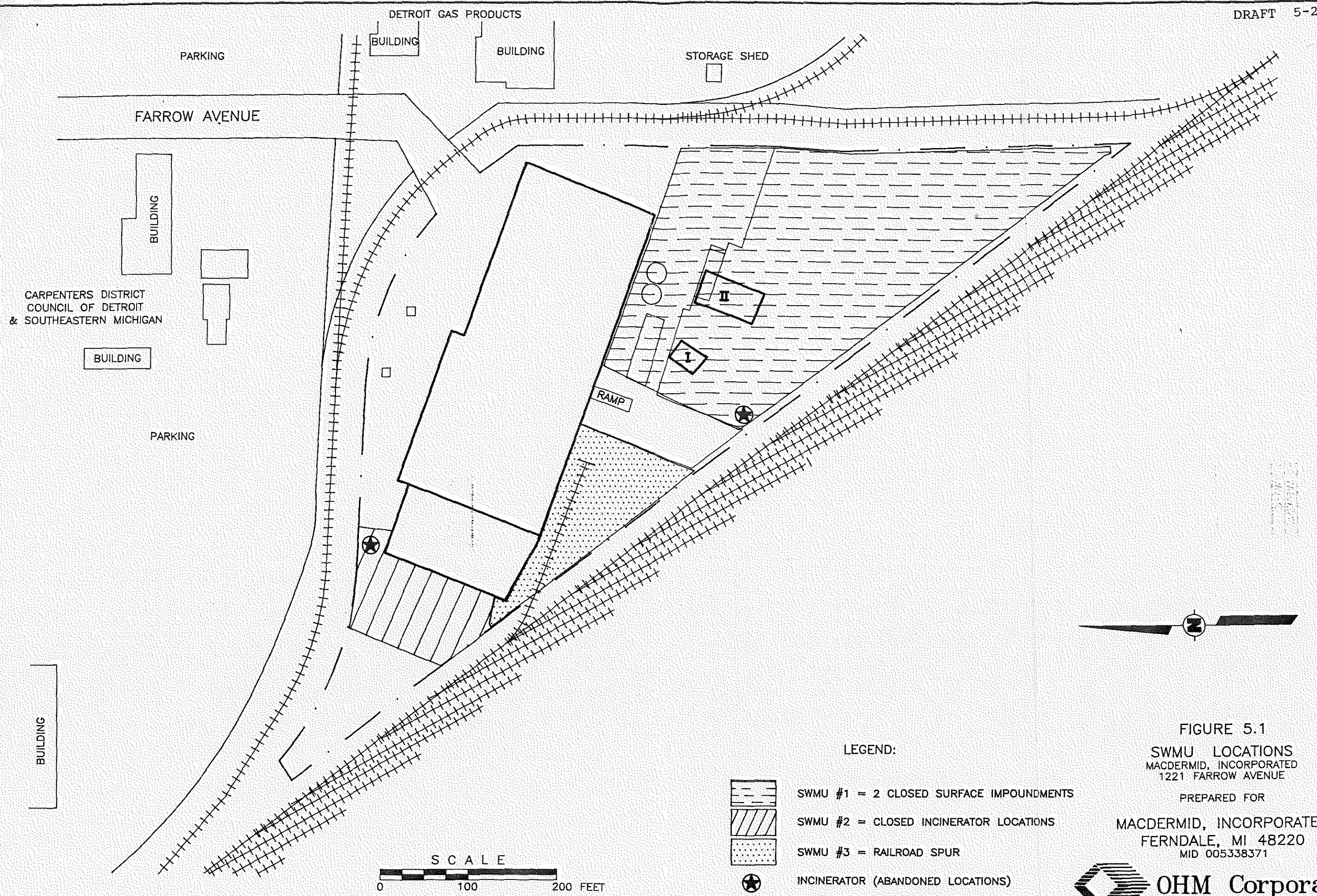
#### 5.1.1 Lagoon No. 1

Although this facility was operational in mid-1966, no evidence of a lagoon was visible on an aerial photograph taken in the spring of 1969 (Oakland County Planning Commission). However, this lagoon is present on the 1973 aerial photograph.

Prior to the excavation of Lagoon No. 1, the facility's process wastewater was pretreated and went directly into the city of Detroit's combination storm/sanitary sewer system. From 1970 through 1971, the wastestream was collected in a



DRAWING 9961A4-1 (FIG 5-1)  
APPROVED BY  
CHECKED BY  
DRAWN BY C.E. MERRIN 1-30-91  
OHM CORPORATION  
FINDLAY, OHIO  
PLOT SCALE: 1" = 1"



LEGEND:

- SWMU #1 = 2 CLOSED SURFACE IMPOUNDMENTS
- SWMU #2 = CLOSED INCINERATOR LOCATIONS
- SWMU #3 = RAILROAD SPUR
- INCINERATOR (ABANDONED LOCATIONS)

FIGURE 5.1  
SWMU LOCATIONS  
MACDERMID, INCORPORATED  
1221 FARROW AVENUE

PREPARED FOR  
MACDERMID, INCORPORATED  
FERNDAL, MI 48220  
MID 005338371



DRAWING 9961A5-2  
NUMBER

APPROVED BY

CHECKED BY

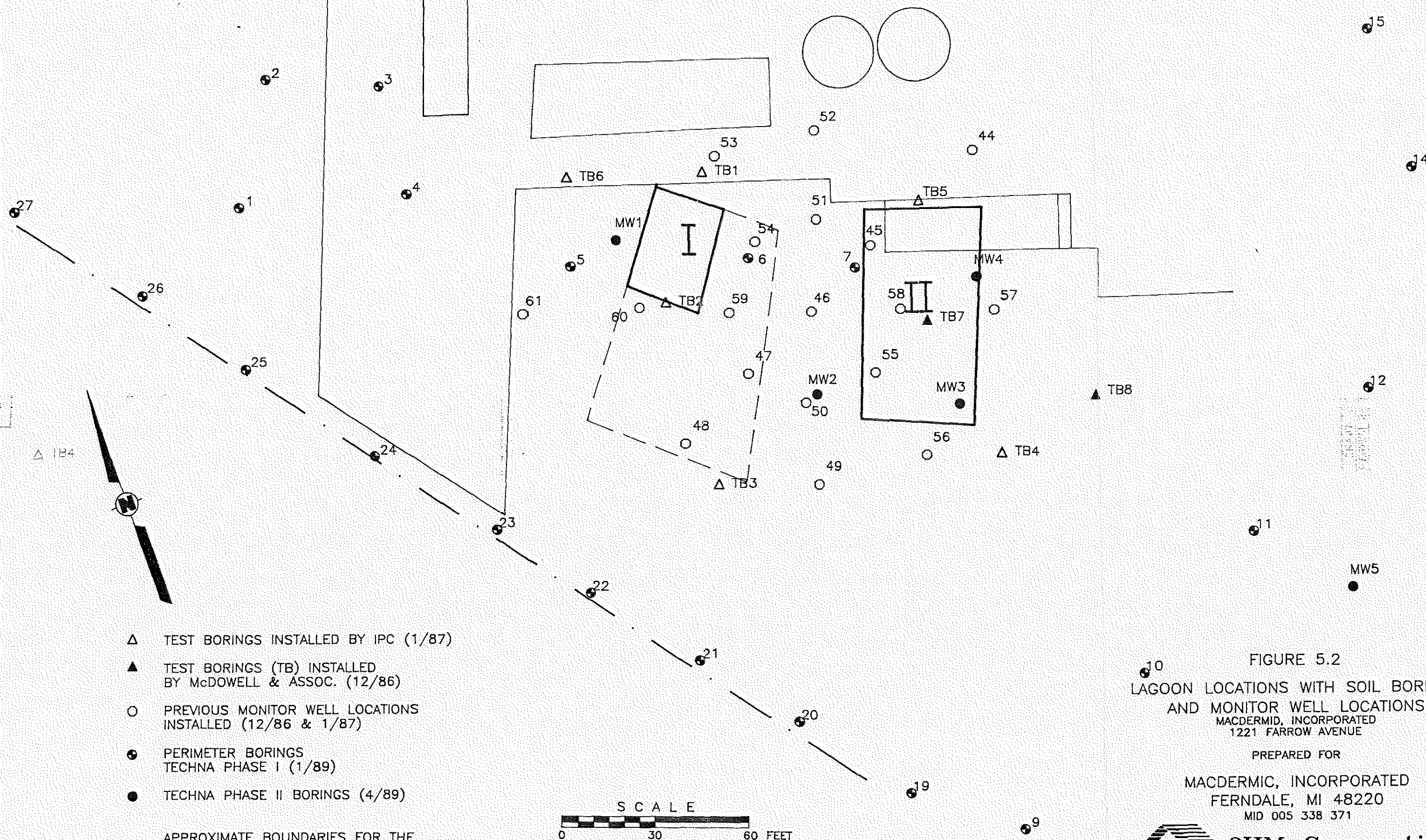
DRAWN BY  
C.E. MERRIN 2-22-91

OHM CORPORATION  
FINDLAY, OHIO

PLOT SCALE: 1" = 1'

MACDERMID BUILDING

DRAFT 5-3




- △ TEST BORINGS INSTALLED BY IPC (1/87)
- ▲ TEST BORINGS (TB) INSTALLED BY McDOWELL & ASSOC. (12/86)
- PREVIOUS MONITOR WELL LOCATIONS INSTALLED (12/86 & 1/87)
- PERIMETER BORINGS TECHNIA PHASE I (1/89)
- TECHNIA PHASE II BORINGS (4/89)
- APPROXIMATE BOUNDARIES FOR THE 1974 LAGOON I ENLARGEMENT.

SCALE  
0 30 60 FEET

FIGURE 5.2  
LAGOON LOCATIONS WITH SOIL BORINGS  
AND MONITOR WELL LOCATIONS  
MACDERMID, INCORPORATED  
1221 FARROW AVENUE

PREPARED FOR  
MACDERMIC, INCORPORATED  
FERNDAL, MI 48220  
MID 005 338 371

 OHM Corporation

sump. From the sump it was pumped on site into wastewater-treatment tanks and run through an ammonia interceptor before being released to the combination storm/sanitary sewer.

Lagoon No. 1 is the most westerly of the two surface impoundments (see Figure 5.2). It is located approximately 30 feet from the south line of the property and 65-feet southeast of the south line of the building. The lagoon dimensions are approximately 60-feet long by 40-feet wide by 10-feet deep, equaling 24,000 cubic feet or 889 cubic yards.

This lagoon was excavated in native clay which served as the only means of containment. In 1974, the sides of this lagoon were re-excavated because they were beginning to slope inward. The lagoon was used as a pit for hydrochloric and sulfuric acid baths and process wastewater. In 1976, sulfuric acid was accidentally added to a hydrochloric acid tank causing the mixture to fume. It was pumped out of the tank and into Lagoon No. 1 where it continued to fume. The lagoon finally had to be covered over with soil and was eventually filled-in following this incident. Soil from the excavation of the second lagoon was used to fill Lagoon No. 1.

#### 5.1.1.1 Lagoon No. 1 -- Ground-Water Monitoring and Sampling

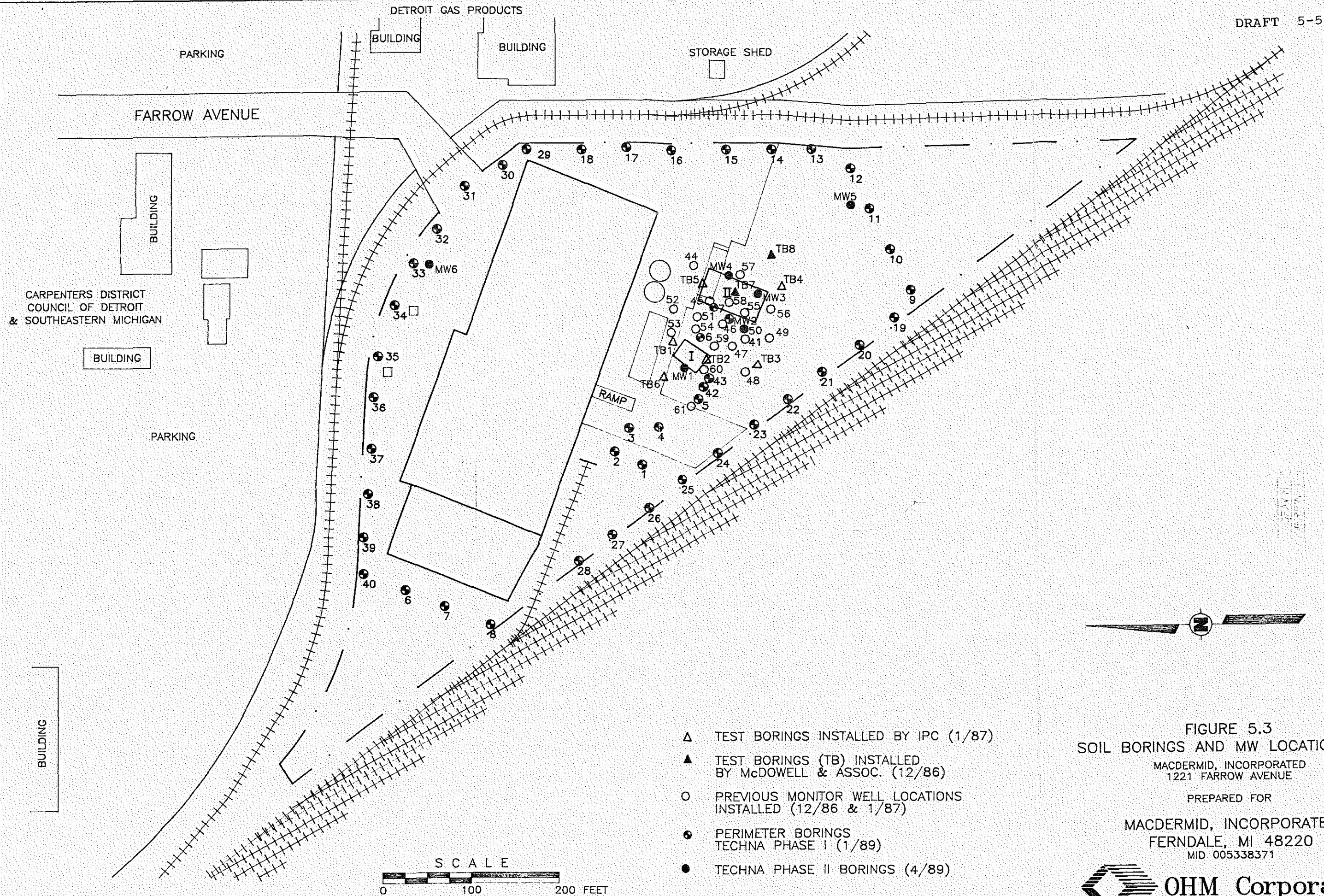
Initial soil and ground-water investigations commenced in December 1986, when ASTI installed 4 two-inch diameter, PVC monitor wells (MWs) in conjunction with the first IPC investigation (report dated April 1987). Two of these wells (MW1 and MW2) were in the immediate vicinity of Lagoon No. 1 (see Figure 5.3). The depth to water in these wells ranged from a high of 7.71 feet (from the top of the casing [TOC]) in MW1 which was located along the northwest side of Lagoon No. 1, to a low of 11.24 feet (from TOC) in MW2, located between the two lagoons on the southerly end (see Table 5.1). Ground-water flow is to the southeast, which is toward the lagoon area.

Samples of the ground water were also collected from these two MWs, filtered in the field, and analyzed for chromium, copper, nickel, zinc, arsenic, barium, cadmium, lead, mercury, selenium, silver, cyanide, phosphorous, and pH (see Table 5.2). In MW1, chromium was slightly above the maximum contaminant level (MCL) on the Primary Drinking Water Standards List (see Table 5.3). The concentration was 0.08 ppm. Nickel, although not on the Primary Drinking Water Standards List, had a concentration of 0.72 ppm in MW1. All other analytes were nondetectable. Measurable concentrations of nickel (4.0 ppm) and zinc (0.018 ppm) were detected in the ground-water sample from MW2, however neither nickel or zinc appear on the Primary Drinking Water Standards List. All other constituents analyzed in MW2 were below detection limits.



DRAWING NUMBER 9961A4-1 (FIG 5-3)  
 APPROVED BY  
 CHECKED BY  
 DRAWN BY C.E. MERRIN 1-30-91  
 OHM CORPORATION FINDLAY, OHIO  
 PLOT SCALE: 1" = 1'

DRAFT 5-5



- ▲ TEST BORINGS INSTALLED BY IPC (1/87)
- ▲ TEST BORINGS (TB) INSTALLED BY McDOWELL & ASSOC. (12/86)
- PREVIOUS MONITOR WELL LOCATIONS INSTALLED (12/86 & 1/87)
- PERIMETER BORINGS TECHNA PHASE I (1/89)
- TECHNA PHASE II BORINGS (4/89)

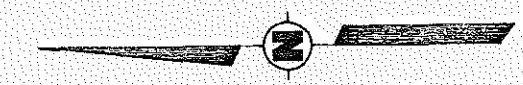
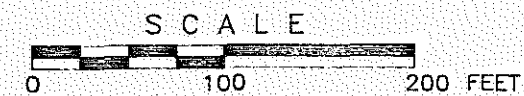


FIGURE 5.3  
 SOIL BORINGS AND MW LOCATION MAP  
 MACDERMID, INCORPORATED  
 1221 FARROW AVENUE  
 PREPARED FOR  
 MACDERMID, INCORPORATED  
 FERNDAL, MI 48220  
 MID 005338371  
 OHM Corporation



TABLE 5.1  
GROUND-WATER ELEVATIONS\*

<u>Monitoring Well No.</u>	<u>Elevation Top Of Casing (feet)</u>	<u>Grade Elevation (feet)</u>	<u>Depth To Ground Water From Top Of Casing (feet)</u>	<u>Ground-Water Elevation (feet)</u>
1	102.70	100.0	7.71	94.99
2	103.66	100.76	11.24	92.42
3	103.00	100.14	10.16	92.84
4	101.90	98.69	9.63	92.27
5	101.94	99.72	7.14	94.80
6	98.19	98.19	0.96	97.23

\* The top of the tank farm containment wall (southeast corner) was used as a bench mark and was assigned an elevation of 100.0 feet. All elevations shown are relative to this benchmark. IPC April 1987.

**TABLE 5.2**

**METALS ANALYSIS – GROUNDWATER**  
**(Applied Science & Technology, 2/87)**  
 (mg/L)

Parameter	Monitoring Wells Sampled					
	MW 1	MW 2	MW 3	MW 4	MW 3 (duplicate)	Field Blank
Arsenic	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Barium	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100
Cadmium	< 0.005	< 0.008	< 0.005	< 0.005	< 0.005	< 0.005
Chromium	0.080	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Copper	< 0.020	0.020	< 0.020	< 0.020	< 0.020	< 0.020
Lead	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Mercury	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Nickel	0.720	4.000	2.200	0.080	2.000	< 0.020
Silver	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Zinc	< 0.030	0.018	0.070	0.020	0.048	0.008
Phosphorous (total)	< 0.200	< 0.200	6.200	4.400		< 0.200
Cyanide (total)	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Selenium	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
pH (average)	7.230	7.020	6.710	7.730		

TABLE 5.3  
 GROUND-WATER EVALUATION CRITERIA

<u>Constituents</u>	<u>Class*</u>	<u>USEPA Primary Drinking Water Standards (ppm)</u>	<u>MDNR Selected Type B Cleanup Criteria (ppm)</u>
Arsenic	A	0.05	$2 \times 10^{-5}$
Barium		1	5
Cadmium	B1	0.010	--
Chromium		.05	--
Copper		--	--
Lead	B2	0.05	0.005
Mercury (Inorganic)	D	0.002	0.002
Nickel	D	--	--
Silver	D	0.05	--
Zinc		--	--
Phosphorus (Total)		--	--
Cyanide (Total)	D	0.7	0.14
Selenium		0.01	--

\* Class A and B = Carcinogen

Class D = Systemic toxicant

Constituents concentrations in the ground-water monitoring well samples described above are less than the MDNR levels assigned according to the Type B cleanup criteria (see Table 5.3). It should be noted that nickel has no Type B cleanup criteria level at the present time.

#### 5.1.1.2 Lagoon No. 1 -- Soil Background Data Analysis

Two 2-inch diameter, PVC monitor wells (MW5 and MW6) were installed by McDowell and Associates on February 26 and 27, 1987. MW5 was located approximately 140-feet southeast of the easterly lagoon. MW6 was 100-feet north of the building (see Figure 5.3). These MW locations were drilled for the primary purpose of providing background data on the soils and ground water at the site.

Continuous soil samples were collected using the split-spoon sampling method. A hollow-stem auger drilling rig was used to enlarge and advance the holes after each split-spoon sample was collected. Samples collected from the 4- to 6-foot interval in both well borings (MW5 and MW6) were analyzed for chromium, copper, nickel, zinc, arsenic, barium, cadmium, lead, mercury, selenium, silver, and cyanide (see Table 5.4).

Approximately 6 months later (between April 1987 and August 1987) the soil samples from MW5 and MW6 were re-analyzed for arsenic and barium concentrations from the 4- to 6-foot interval. The 6- to 8-foot sample intervals from MW5 and MW6 were also analyzed at this time for all 12 constituents. From these analyses, four total sets of background data were obtained. The constituent concentrations for MW5 and MW6 were each analyzed from the following intervals: 4 to 6 feet and 6 to 8 feet. The 4- to 6-foot interval was more representative of the composite samples analyzed from the later site investigations. Therefore, the 4- to 6-foot interval was selected for purposes of background determinations and comparative concentrations.

In addition to the site-specific MW background data, background constituent concentrations native to the Erie glacial lobe of clay deposits which blanket the southeast portion of Michigan were found to be applicable to this site. Using this local background data from the MDNR's soil survey analysis, action levels were calculated by taking the mean of the background concentrations plus three times the standard deviation of a particular constituent [action level = mean + (3 x standard deviation)], (Attachment I to the MDNR Draft Guidance, August 29, 1988) (see Appendix G for calculations). This Gossett Student T-Test calculation was also used in the calculation of the action levels for the background constituents analyzed in MW5 and MW6.



**TABLE 5.4**  
**SOIL BACKGROUND DATA**  
(mg/kg)

Boring No.	Sample Depth	Cr	Cu	Ni	Zn	As	Ba	Cd	Pb	Hg	Se	Ag	CN
Action Level Range		41 - 57	29 - 41	42 - 2000	78 - 87	21 - 80	162 - 281	3.8 - 40	19 - 32	0.14 - 20	0.89 - 1.2	3.8 - 200	0.5 - 2000

IPC

MW-5	4 - 6'	9.60	11.00	15.00	28.00	7.50	43.00	0.58	5.2	ND	0.65	ND	0.06
MW-5	6 - 8'	13.00	9.00	15.00	39.00	7.50	37.00	0.65	5.5	0.027	* 30.00	ND	ND
MW-6	4 - 6'	10.00	15.00	24.00	46.00	ND	43.00	2.20	5.4	ND	0.09	ND	ND
MW-6	6 - 8'	13.00	8.00	24.00	46.00	11.00	47.00	0.60	ND	0.032	* 8.00	ND	ND

**SOIL BORINGS - METALS ANALYSIS**

IPC

TB-1	4 - 6'	32.00	* 49.00	180.00	* 850.00	< 5.00	75.00	0.75	< 2.50	0.024	* < 5.00	< 0.50	0.03
TB-2	4 - 6'	9.90	32.00	22.00	* 190.00	ND	55.00	1.50	15.00	0.034	* 40.00	< 0.50	< 0.03
TB-3	4 - 6'	12.00	15.00										
TB-4	4 - 6'	* 67.00	* 370.00										
TB-5	4 - 6'	* 1340.00	* 300.00										
TB-6	4 - 6'	21.00	* 44.00	17.00	* 140.00	< 5.00	48.00	2.00	< 2.50	0.046	* < 5.00	< 0.50	< 0.03

McDowell & Assoc.

TB-7	4 - 6'	* 280.00	* 100.00		* 340.00	0.85	2.40	0.86	* 120.00	0.092	ND	ND	0.12
TB-7	9 - 11'	11.00	7.60		23.00	3.30	1.20	0.90	12.00	ND	0.008	ND	ND
TB-7	14 - 16'	12.00	8.20		18.00	5.50	2.10	1.00	13.00	ND	ND	ND	ND
TB-8	4 - 6'	23.00	* 100.00		* 460.00	6.00	3.70	3.10	28.00	0.33	ND	ND	ND
TB-8	6 - 9'	17.00	12.00		38.00	1.90	2.10	0.94	17.00	0.11	ND	ND	ND

 - IPC Report 4/87 & analyses from McDowell & Assoc. sampling (2/87)

 - IPC Report 8/87

 - exceeds Action Levels

In an effort to account for local variations in the naturally occurring background soil concentrations and the lack of available proposed action levels for all of the constituents involved, action level ranges were used to evaluate constituent concentrations encountered at the site (see Table 5.5). One range is based on the USEPA proposed action levels (55 CFR 30868) and the calculated background concentration action levels for the monitor well borings at the corresponding depth. The second range involves the calculated monitoring well action levels and MDNR background concentration calculated action levels in the absence of USEPA action levels. The third range is used if the constituent concentration of the monitoring well is below detection limits, then USEPA proposed action levels have been used with MDNR background concentration calculated action levels.

Action level ranges may be used as a guideline for constituent concentration evaluation for the predetermination of possible remedial measures. Contaminant concentrations over proposed action levels can initiate the need for a Corrective Measures Study unless site-specific conditions require their modification.

#### 5.1.1.3 Lagoon No. 1 -- Soil Sampling and Analysis

As part of the first IPC report (dated April 1987), eight test borings (TB) were advanced in the closed surface impoundment area from February 26 to February 27, 1987. A hollow-stem auger rig was used to advance the boreholes after driving and recovering each continuous, 2-foot, split-spoon sample.

TB1, TB2, TB3, and TB6 were advanced in and around the area of Lagoon No. 1 (see Figure 5.3, Soil Borings and Monitor Well Locations). TB1 and TB6 were located on the north and northwest side of Lagoon No. 1, respectively. TB2 was located in the west half of the lagoon. TB3 was south of Lagoon No. 1, approximately 5-feet north of the south property line. Soil samples from 4 to 6 feet in TB1, TB2, and TB6 were analyzed for chromium, copper, nickel, zinc, arsenic, barium, cadmium, lead, mercury, selenium, silver, and cyanide (see Table 5.6, Lagoon No. 1 Analytical Data). Samples from the 4- to 6-foot interval in TB3 were analyzed for chromium and copper, only. Action level ranges, as described in Section 5.1.1.2, were used as a guideline in media evaluation for remediation purposes (see Table 5.5, Inorganic Contaminant Action Level Ranges For Soils).

Copper (49 mg/kg) and zinc (650 mg/kg) exceeded the action level ranges in TB1, with nickel (180 mg/kg) falling between the range limits. Constituent concentrations in TB6 were over the action level ranges for copper (44 mg/kg) and zinc (140 mg/kg). Concentrations of selenium in these two

**TABLE 5.5**

INORGANIC CONTAMINANT ACTION  
LEVEL RANGES FOR SOILS  
(mg/kg, 4 to 6 feet)

Arsenic	21 <sup>b</sup> to 80 <sup>a</sup>	8000 ppm
Barium	162 <sup>b</sup> to 281 <sup>c</sup>	
Cadmium	3.8 <sup>b</sup> to 40 <sup>a</sup>	40 ppm
Chromium	41 <sup>b</sup> to 57 <sup>c</sup>	
Copper	29 <sup>b</sup> to 41 <sup>c</sup>	
Cyanide	0.5 <sup>b</sup> to 2,000 <sup>a</sup>	ppm
Lead	19 <sup>b</sup> to 32 <sup>c</sup>	
Mercury	0.14 <sup>c</sup> to 20 <sup>a</sup>	10 ppm
Nickel	42 <sup>b</sup> to 2,000 <sup>a</sup>	ppm
Silver	3.8 <sup>c</sup> to 200 <sup>a</sup>	ppm
Selenium	0.89 <sup>c</sup> to 1.2 <sup>b</sup>	
Zinc	78 <sup>b</sup> to 87 <sup>c</sup>	

a = Action level that the USEPA believes to be appropriate;  
USEPA Proposed Action levels July 27, 1990 (55 CFR 30798)

b = Action level defined by WMD/MDNR as A.L. =  $\bar{x} + 3s$

c = Action level defined using MI Erie clay background soil survey data, A.L. =  $\bar{x} + 3s$

**TABLE 5.6**  
**LAGOON I - ANALYTICAL DATA**  
(mg/kg)

Boring No.	Sample Depth	Cr	Cu	Ni	Zn	Sb	As	Ba	Be	Cd	Pb	Hg	Se	Ag	Tl	CN	P	Avg pH
Action Level Range		41-57	29-41	42-2000	78-87		21-80	162-281		3.8-40	19-32	.14-20	.89-1.2	3.8-200		.5-2000		

IPC - 1/87

TB-1	4' - 6'	32.00	49.00	180.00	650.00		< 5.00	75.00		0.75	<2.50	0.024	<5.00	<500		0.03		
TB-2	4' - 6'	9.90	32.00	22.00	190.00		< 5.00	55.00		1.50	15.00	0.034	40.00	<500		<0.03		
TB-3	4' - 6'	12.00	15.00															
TB-6	4' - 6'	21.00	44.00															

TECHNA - Phase I, 1/89

B-5	(1)*	0.04	0.08	1.30	2.40		<.005	0.60		0.04	0.28	<.002	<.005	<.02				
B-5	1' - 2.5'	14.00	19.00	24.00	110.00	12.00	0.01	47.00	0.40	0.90	23.00	0.06	0.01	0.60	7.00			
B-5	3' - 5'	19.00	23.00	130.00	220.00	11.00	0.12	69.00	0.40	0.80	23.00	0.01	0.01	0.50	5.00			
B-5	(2)	17.00	16.00	32.00	4.90													
B-42	3' - 5'	9.20	5.60	10.00	25.00	7.20	0.05	24.00	0.10	0.50	6.30	0.02	0.02	0.02	23.00			
B-43																		

TECHNA - Phase II, 4/89

B-47	(3)	42.00	110.00	94.00	650.00						100.00							
B-48	(3)	9.60	140.00	22.00	400.00						150.00							
B-53	(3)	7.20	13.00	48.00	32.00						17.00							
B-54	(3)	10.00	210.00	110.00	720.00						170.00							
B-54	(4)	9.10	10.00	43.00	18.00						14.00							
B-59	(3)	31.00	55.00		24.00		2.50	68.00		2.00	80.00	0.15	0.14	0.60	6.50			
B-59	(4)	56.00	200.00	760.00	2700.00						18.00							
B-60	(3)	110.00	200.00		370.00		2.50	64.00		0.80	100.00	0.24	0.09	0.60	7.20			
B-60	(4)	7.90	17.00	43.00	52.00						18.00							
B-61	(3)	200.00	36.00	3700.00	210.00						30.00							
B-61	(4)	17.00	19.00	32.00	82.00						19.00							

Ground-Water Analysis

MW-1	NW SIDE	0.08	<0.02	0.72	< .03		<.005	<0.1		<.005	<.05	<.002	<.005	<.01		<0.01	<0.2	7.23
MW-2	M SIDE	0.05	0.02	4.00	0.018		<.005	<0.1		0.008	<.05	<.002	<.005	<.01		<0.01	<0.2	7.02

 - exceeds Action Levels

- (1) - Composite from 1' to 2.5' & 3.5' to 5'
- (2) - Interval sampled from 6' to 7.5'
- (3) - Composite sample: 2' & 5'
- (4) - Sample depth is 8'
- \* - TCLP analysis



borings cannot be accurately quantified due to the high limits of detection (<5.0) used for that constituent in this analysis. In TB2 the concentration of copper (32 mg/kg) was between the action level range values. TB2 had elevated concentrations of zinc (190 mg/kg) and selenium (40 mg/kg) which were both over the action level range.

Although concentration levels of selenium were above the established range limits in TB2, possibly in TB1 (i.e., <5.0 mg/kg), selenium concentrations generally were below detection limits when analyzed. It is important to note that selenium has not been a major constituent in the manufacturing processes or recycling operation at the Ferndale facility. Based on this information, selenium has not been recognized as an indicator parameter at this site.

In 1989, Techna initiated a two phase soil sampling program. The Phase I report (dated January 1989) included a site perimeter soil sampling program encompassing a total of 31 borings (B9 through B40) augered to between 5.0- and 7.5-feet deep. Phase II focused on the closed surface impoundment area.

A total of four borings were advanced in the lagoon area during Phase I. Three of these soil sample borings (B5, B42, and B43) were located in Lagoon No. 1. B5 was located along the west wall of the old pit (see Figure 5.3, Soil Borings and Monitor Well Locations). B42 and B43 are both located in the northwest quarter of Lagoon No. 1. These borings went to 10.0- to 10.5-feet deep. Sampling intervals ranging from 1- to 5-feet deep were analyzed for the following constituents: chromium, copper, nickel, zinc, antimony, arsenic, barium, beryllium, cadmium, lead, mercury, selenium, silver, and thallium.

Of the constituents with sufficient data to have action levels listed or calculated, action levels were assigned. Only concentrations of zinc (110 mg/kg, 220 mg/kg) in B5 from 1.0 to 2.5 feet and from 3 to 5 feet, respectively, exceeded the action level ranges (see Table 5.6). Concentrations of lead (23 mg/kg) and nickel (130 mg/kg) fell between range limits in B5 from the 3- to 5-foot sample interval. In B5 from 1.0 to 2.5 feet, lead (23 mg/kg) is also between range limits. The 2-foot sample from B5 was only analyzed for chromium, copper, nickel, and zinc, of which none exceeded the proposed action levels. Inorganic constituents analyzed in B-42 were below action levels given. No inorganic analysis was available on B-43.

Organic constituents were analyzed on composite samples from B42 and B43 from a depth interval of 9.0 to 10.5 feet using three different laboratories. Acid/Base Extraction-Standard Method 625 by Shrader Labs (see Table 5.7), Purgeables 601/602 by Dihydro (see Table 5.8), and Semi

**TABLE 5.7**  
**ACID/BASE EXTRACTION STANDARD METHOD 625**  
**B-42 & B-43**

Compound	Concentration (mg/kg)	Detection Limit (mg/kg)
acrolein	ND	7.5
acrylonitrile	ND	900
benzene	ND	60
bromodichloromethane	ND	200
bromoform	ND	200
bromomethane	ND	200
carbon tetrachloride	ND	200
chlorobenzene	130000	20
chloroethane	ND	300
2-chloroethyl vinyl ether	ND	23,000
chloroform	190	100
chloromethane	ND	100
dibromochloromethane	ND	400
1,1-dichloroethane	ND	200
1,2-dichloroethane	ND	200
1,1-dichloroethene	ND	200
1,2-dichloropropane	ND	200
cis-1,3-dichloropropene	ND	200
trans-1,3-dichloropropene	ND	300
ethyl benzene	< 40	40
methylene chloride	21000	100
sym-tetrachloroethane	ND	100
tetrachloroethene	ND	50
toluene	180	20
t-1,2-dichloroethene	ND	200
1,1,1-trichloroethane	ND	100
1,1,2-trichloroethane	ND	400
trichloroethene	ND	200
trichlorofluoromethane	ND	100
vinyl chloride	ND	100
meta-,para-xylenes	22	2
ortho-xylene	11	0.9
styrene	ND	0.2

ND – below reported detection limit

soil sample no. 88-07-66 (B-42 & B-43, composite; 9.0' to 10.5')  
sample analyzed 8/9/88

**TABLE 5.8**  
**PURGEABLES (601/602)**  
**B-42 & B-43**

Compound	Concentration (mg/kg)	Detection Limit (mg/kg)
dichlorodifluoromethane	ND	20 <i>OK</i>
chloromethane	ND	63 <i>70</i>
vinyl chloride	ND	75 <i>500</i>
chloroethane	ND	67 <i>70</i>
bromomethane	ND	60 <i>OK</i>
1,1-dichloroethene	ND	8 <i>70</i>
methylene chloride	6000	40 <i>OK</i>
t-1,2-dichloroethene	ND	4 <i>70</i>
1,1-dichloroethane	ND	6 <i>70</i>
c-1,2-dichloroethene	ND	4 <i>70</i>
chloroform	ND	20 <i>OK</i>
1,1,1-trichloroethane	ND	40 <i>OK</i>
carbon tetrachloride	ND	4
benzene	ND	8 <i>70</i>
1,2-dichloroethane	ND	4 <i>OK</i>
trichloroethene	ND	10
1,2-dichloropropane	ND	4
bromodichloromethane	ND	10
2-chloroethylvinyl ether	ND	10
t-1,3-dichloropropene	ND	20
toluene	ND	4 <i>OK</i>
c-1,3-dichloropropene	ND	24
1,1,2-trichloroethane	ND	22
tetrachloroethene	ND	14
dibromochloromethane	ND	20
chlorobenzene	23000	4 <i>OK</i>
ethyl benzene	95	6 <i>OK</i>
meta-,para-xylene	ND	8
ortho-xylene	ND	4
bromoform	ND	18 <i>OK</i>
1,1,2,2-tetrachloroethane	ND	14 <i>OK</i>
1,3-dichlorobenzene	ND	8
1,4-dichlorobenzene	ND	8
1,2-dichlorobenzene	180	8
total PCBs	< 1.0	

ND - below reported detection limit

soil sample no. 88-07-66 (B-42 & B-43, composites; 9.0' to 10.5')  
sample analyzed 7/28/88

Volatiles Method 8270 by Biological and Environmental Control Labs (see Table 5.9) were run on the soil samples from the above borings.

From the MDNR constituent list for "Selected Type B Cleanup Criteria" (June 22, 1990) and the proposed list of USEPA action levels, range limits were established for the purpose of site constituent concentration evaluation (see Table 5.10, Organic Contaminant Action Levels). From the analytical results of the composite samples from B42 and B43 (9.0 to 10.5 feet), chlorobenzene (130,000 mg/kg), chloroform (190 mg/kg), and methylene chloride (21,000 mg/kg) were above the action level ranges according to the Acid/Base Extraction-Standard Methods 625.

For the Purgeables analysis (see Table 5.8), methylene chloride (6,000 mg/kg) was once again above the action level ranges, chlorobenzene was 23,000 mg/kg and 1,2-dichlorobenzene was 180 mg/kg. Using Semi Volatile Analysis Method 8270 (see Table 5.9), 1,2-dichlorobenzene (37 mg/kg) was detected above the established action level ranges. Naphthalene (10 mg/kg) was also above the action level range; 1,2-dichlorobenzene was analyzed at 37 mg/kg and above the action level range. Concentrations of 1,3-dichlorobenzene (71 mg/kg), and 1,4-dichlorobenzene (56 mg/kg) have also been measured in these soil samples.

The Phase II portion of the Techna sampling program concentrated on the lagoon area. A total of 18 borings were advanced to total depths ranging from 8.5 to 12.0 feet. Seven of these borings were done in and around the location of Lagoon No. 1. B47, B48, B54, B59, and B60 are located within perimeters of the old lagoon (see Figure 5.3). B53 is on the north side of the lagoon and B61 is to the west.

All of the above borings (associated with Lagoon No. 1) had soil samples analyzed from composite samples at 2 and 5 feet. Four borings (B54, B59, B60, and B61) had soil samples analyzed from 8-feet deep. All soil samples were analyzed for the following constituents: chromium, copper, nickel, zinc, and lead (see Table 5.6). Additional constituent analyses were run on B59 and B60 from composite samples collected from 2 and 5 feet. They were arsenic, barium, mercury, selenium, silver, and thallium. Concentrations of these constituents were under the action level ranges, except for mercury which had concentrations within the range limits in B59 and B60 from the 2 and 5 foot composite sample interval.



TABLE 5.9

**SEMI-VOLATILES METHOD 8270  
B-42 & B-43**

Compound	Concentration (mg/kg)
acenaphthene	< 10
acenaphthylene	< 10
anthracene	< 10
benzoic acid	10
benzo (a) anthracene	< 10
benzo (a) pyrene	< 10
benzo (b) fluoroanthene	< 10
benzo (k) fluoroanthene	< 10
benzo (ghi) perylene	< 10
benzyl alcohol	< 10
bis (2-chloroethoxy) methane	< 10
bis (2-chloroethyl) ether	< 10
bis (2-chloroisopropyl) ether	< 10
bis (2-ethylhexyl) phthalate	30
4-bromophenyl phenyl ether	< 10
butyl benzyl phthalate	< 10
4-chloroaniline	< 10
2-chloronaphthalene	< 10
4-chlorophenyl phenyl ether	< 10
chrysene	< 10
dibenzo (a,h) anthracene	< 10
dibenzofuran	< 10
1,2-dichlorobenzene	37
1,3-dichlorobenzene	71
1,4-dichlorobenzene	56
3,3-dichlorobenzidene	< 10
diethyl phthalate	< 10
dimethyl phthalate	< 10
di-n-butyl phthalate	< 10
2,4-dinitrotoluene	< 10
2,6-dinitrotoluene	< 10
di-n-octyl phthalate	65
fluoranthene	< 10
fluorene	< 10
hexachlorobenzene	< 10
hexachlorobutadiene	< 10
hexachlorocyclopentadiene	< 10
hexachloroethane	< 10
indeno (1,2,3-cd) pyrene	< 10
isophorone	< 10
2-methylnaphthalene	< 10
naphthalene	10
2-nitroaniline	< 10
3-nitroaniline	< 10
4-nitroaniline	< 10
nitrobenzene	< 10
N-nitroso-n-propylamine	< 10
N-nitrosodiphenylamine	< 10
phenanthrene	< 10
pyrene	< 10
1,2,4-trichlorobenzene	< 10

soil sample no. 88-07-66 (B-42 & B-43, composites; 9.0' to 10.5')  
sample analyzed 8/9/88

TABLE 5.10  
ORGANIC CONTAMINANT ACTION LEVELS

	Soils (mg/kg)	Water (ppm)
Chlorobenzene	2.8 <sup>b</sup> to 2,000 <sup>a</sup>	0.14 <sup>b</sup> to 0.7 <sup>a</sup>
Ethylbenzene	0.6 <sup>b</sup> to 8,000 <sup>a</sup>	0.03 <sup>b</sup> to 4.0 <sup>a</sup>
Toluene	0.8 <sup>b</sup> to 20,000 <sup>a</sup>	0.04 <sup>b</sup> to 10.0 <sup>a</sup>
Xylenes	0.4 <sup>b</sup> to 200,000 <sup>a</sup>	0.02 <sup>b</sup> to 70.0 <sup>a</sup>
Methyl chloride	--	--
1,2-dichlorobenzene	12 <sup>b</sup>	0.6 <sup>b</sup>
1,3-dichlorobenzene	--	--
Chloroform	0.12 <sup>b</sup> to 100 <sup>a</sup>	0.006 <sup>a/b</sup>
bis(2-ethylhexyl phthalate)	50 <sup>a</sup>	0.003 <sup>a</sup>
Naphthalene	0.8 <sup>b</sup>	0.04 <sup>b</sup>
Methylene chloride	0.1 <sup>b</sup> to 90 <sup>a</sup>	0.005 <sup>a/b</sup>

a = USEPA action level

b = Type B, MDNR

All composite (2 and 5 foot) samples analyzed from borings within the area of Lagoon No. 1 were over the action level range limits for copper and lead:

	<u>Copper</u>	<u>Lead</u>
B47	110 mg/kg	100 mg/kg
B48	140 mg/kg	150 mg/kg
B54	210 mg/kg	170 mg/kg
B59	200 mg/kg	80 mg/kg
B60	200 mg/kg	100 mg/kg

B54, B48, and B47 were over the action level ranges for zinc. The concentrations were:

- o B47 = 650 mg/kg
- o B48 = 400 mg/kg
- o B54 = 720 mg/kg

The deep (8 foot) sample from B59 had elevated concentrations of zinc (2700 mg/kg). Nickel and chromium concentrations were between the range limits, 760 mg/kg and 56 mg/kg, respectively. B60 (2 and 5 foot composite sample) exceeded action level range limits for chromium (110 mg/kg and zinc (370 mg/kg).

Concentrations detected in B47 fell between the range limits for chromium (42 mg/kg) and nickel (94 mg/kg). The B54 8-foot sample was analyzed and only nickel concentrations (43 mg/kg) were high enough to be within the action level range limits, all other constituents in B54 were below action level ranges. B60 (8-foot sample) was between range limits for nickel (43 mg/kg), with all other constituents in that sample below action level ranges.

Of the borings outside the area of Lagoon No. 1 (B53 and B61), the chromium concentrations in B61 (2 and 5 foot composite) was 200 mg/kg, the nickel concentration was 3,700 mg/kg and the zinc was 210 mg/kg, all over the action level range limits. Lead in B61 (2 and 5 foot) was within the range limits (30 mg/kg). The deeper (8 foot) sample collected at B61 had concentrations of zinc and lead which fell between the range limits. B53 had nickel concentrations between the range limits, but other constituents were below action level criteria.

Previously, high concentrations of organics were analyzed in the soil samples collected from Lagoon No. 1 during the Phase I Techna investigation (January 1989). Techna's Phase II lagoon investigation attempted to address this situation by analyzing the soil samples collected at B59 and B60 from the 2 and 5 foot composite samples and the separate 5-foot sample. Constituent concentrations were generally magnitudes less in these samples (see Table 5.11, Volatile Organics-Soils 8010/8020).

**TABLE 5.11**  
**VOLATILE ORGANICS – SOILS**  
 USEPA Method 8010/8020  
 (mg/kg)

Boring No.	B-59		B-60	
Depth	2 – 5'	5'	2 – 5'	5'
chlorobenzene	9.0	20.0	11.0	30.0
1,3-dichlorobenzene	ND	0.3	ND	ND
1,2-dichlorobenzene	4.0	12.0	ND	ND
ethyl benzene	0.4	2.0	ND	ND
toluene	ND	0.3	ND	ND
meta-, para-xylenes	2.0	9.0	ND	ND
ortho-xylene	0.7	4.0	ND	ND



Using the USEPA action levels for organic contaminants in soils and the MDNR Type B Cleanup criteria as contaminant range limits, constituent concentrations were above the range level in one case and within the range limits for many of the constituents. 1,2 dichlorobenzene in B59 from the 5-foot sample was equal to the concentration (12 mg/kg) set by the MDNR for Type B cleanup criteria. Those constituents that had concentrations between the established range limits were:

- o 1,3-dichlorobenzene--all samples, B59 and B60
- o Xylenes (total)--all samples, B59

#### 5.1.2 Lagoon No. 2

Lagoon No. 2 was excavated in response to the closing of Lagoon No. 1 in 1976. Lagoon No. 2 was located approximately 40-feet east of Lagoon No. 1 (see Figure 5.2, Lagoon Locations). This lagoon is distinguishable on the 1978 and 1980 aerial photos provided by the Oakland County Planning Commission. Lagoon No. 2 was used to contain process wastewater and hydrochloric and sulfuric acid baths similar to Lagoon No. 1.

Native clay served as the only deterrent to migration. No artificial liner were used. Lagoon No. 2 was approximately 55-feet long by 35-feet wide and encompassed an area of approximately 1,925 square feet. The maximum depth for this pit was estimated at 10 feet. Therefore, the volume of Lagoon No. 2 would be 19,250 cubic feet or 713 cubic yards.

Due to stricter requirements by the MDNR and the city of Ferndale in 1982, Lagoon No. 2 was decommissioned by the city. Liquids and sludge material were removed from Lagoon No. 2 and sent through the wastewater-treatment system. Most of the soils settled in the tanks. The solids in the tanks, plus any additional soil and sludge excavated from the two lagoon areas were hauled off site to a landfill. Unfortunately, some of this material may have been scattered randomly around the site for fill. In 1982, MACDERMID ceased using surface impoundments (lagoons) for waste management and Lagoon No. 2 was replaced by a 4,000-gallon Fiberglass holding tank. Process and wastewater are now handled by the facility wastewater-treatment system (see Section 4.1).

##### 5.1.2.1 Lagoon No. 2 -- Ground-Water Monitoring and Sampling

In the early stages of site investigation (prior to December 1986), McDowell and Associates advanced two soil borings (TB7 and TB8) in the area of Lagoon No. 2 (see Figure 5.3). TB7 was located in approximately the center of the lagoon. A ground-water sample was collected from this boring (see Table 5.12). The sample was analyzed for

TABLE 5.12

**METALS ANALYSIS – GROUNDWATER SAMPLE # 6060523**  
**(McDonald & Associates, 10/86)**  
**TB – 7**

Parameter	Results (mg/L)
Arsenic	4.10
Barium	5.10
Cadmium	0.05
Chromium	0.86
Copper	0.99
Lead	1.80
Mercury	0.0009
Silver	< 0.01
Zinc	2.60
Selenium	0.016

chromium, copper, zinc, arsenic, barium, cadmium, lead, mercury, selenium, and silver. The following constituents were over the MCLs on the Primary Drinking Water Standards List (proposed):

- o Chromium = 0.86 ppm
- o Arsenic = 4.10 ppm
- o Barium = 5.10 ppm
- o Cadmium = 0.05 ppm
- o Lead = 1.80 ppm
- o Selenium = 0.06 ppm

Sampling variants involving the method of sample collection and whether this sample was filtered or not, may tend to bias the metals concentrations in this sample upward (i.e., higher concentrations than actually present). No MCLs or cleanup criteria have been assigned to copper and zinc. The concentration of copper was less than 1.00 ppm in TB7 and zinc was 2.60 ppm.

Two of the six total ground-water monitoring wells installed at this site were located in the vicinity of Lagoon No. 2. MW3 was located along the east side of the lagoon and MW4 was less than 5 feet from the southeast corner. The monitor wells were installed by ASTI in December 1986. Data from these wells was incorporated into April 1987 IPC report.

The depth to ground water in MW3 was 10.16 feet from the TOC (see Table 5.1, Ground-Water Elevations). In MW4 the depth to ground water was 9.63 feet from the TOC. Samples of the ground water were analyzed for chromium, copper, nickel, zinc, arsenic, barium, cadmium, lead, mercury, selenium, silver, cyanide, phosphorous, and pH (see Table 5.13). All concentrations, except those for nickel and zinc, were below detection limits of the analyses, as well as below the proposed MCLs or MDNR Type B cleanup criteria given in the regulations. Concentrations of nickel ranged from a low of 0.08 ppm in MW4 to a high of 2.20 ppm in MW3. The duplicate sample from MW3 followed the results of the primary sample closely. Zinc concentrations ranged from a low of 0.02 ppm in MW4 to a high of 0.07 ppm in MW3.

#### 5.1.2.2 Lagoon No. 2 -- Soil Sampling and Analysis

The first soil samples collected were test borings done by McDowell and Associates (TB7 and TB8) in the area of Lagoon No. 2 prior to December 1986. These borings were analyzed for the following constituents: chromium, copper, zinc, arsenic, barium, cadmium, lead, mercury, selenium, silver, and cyanide (see Table 5.13). The sample from the 4- to 6-foot interval in TB7 had the most constituents with

**TABLE 5.13**  
**LAGOON II - ANALYTICAL DATA**  
(mg/kg)

Boring No.	Sample Depth	Cr	Cu	Ni	Zn	Sb	As	Ba	Be	Cd	Pb	Hg	Se	Ag	Tl	CN	P	pH
Action Level Range		41-57	29-41	42-2000	78-87		21-80	162-281		3.8-40	19-32	.14-20	.89-1.2	3.8-200		.5-2000		

**IPC - 4/87**

TB-4	4' - 6'	67.00	370.00															
TB-5	4' - 6'	1340.0	300.00															
TB-7	4' - 6'	280.00	100.00		340.00		0.85	2.40		0.86	120.00	0.092	ND	<.500		0.12		
TB-7	9' - 11'	11.00	7.60		23.00		3.30	1.20		0.90	12.00	ND	0.008	<.500		ND		
TB-7	14' - 16'	12.00	8.20		18.00		5.50	2.10		1.00	13.00	ND	ND	<.500		ND		
TB-8	4' - 6'	23.00	100.00		460.00		6.00	3.70		3.10	28.00	0.33	ND	<.500		ND		
TB-8	6' - 9'	17.00	12.00		38.00		1.90	2.10		0.94	17.00	0.11	ND	<.500		ND		

**IPC - 8/87**

TB-10	3' - 5'	5.00	6.50															
TB-11	3' - 5'	160.00	71.00															
TB-12	3' - 5'	32.00	160.00															
TB-13	1' - 3'	37.00	950.00															
TB-14	1' - 3'	14.00	74.00															
TB-15	3' - 5'	5.50	5.00															
TB-16	5' - 7'	60.00	130.00															
TB-17	3' - 5'	10.00	7.00															
TB-18	5' - 7'	53.00	28.00															
TB-19	1' - 3'	150.00	8.50															
TB-20	3' - 5'	27.00	68.00															

**TECHNA - Phase I, 1/89**

B-41	(1)*	< 0.04	0.02	2.10	0.96		<.005	0.20		0.02	0.14	<.002	<.005	0.02				
B-41	1' - 2.5'	19.00	17.00	20.00	66.00	10.00	0.07	35.00	0.2	0.80	14.00	0.03	0.007	0.80	4.70			

■ - exceeds Action Levels

(1) - Composite from 1' to 2.5' & 3.5' to 5'

\* - TCLP analysis



TABLE 5.13

**LAGOON II – ANALYTICAL DATA (cont)**  
(mg/kg)

Boring No.	Sample Depth	Cr	Cu	Ni	Zn	Sb	As	Ba	Be	Cd	Pb	Hg	Se	Ag	Tl	CN	P	pH
Action Level Range		41-57	29-41	42-2000	78-87		21-80	162-281		3.8-40	19-32	.14-20	.89-1.2	3.8-200		.5-2000		

## TECHNA – Phase II, 4/89

B-44	(3)	20.00	24.00	64.00	100.00						45.00							
B-44	(4)	9.70	10.00	190.00	33.00						16.00							
B-45	(3)	340.00	120.00		570.00		1.80	42.00		0.80	130.00	0.22	0.11	4.00	5.50			
B-46	(3)	8.10	11.00	16.00	39.00						12.00							
B-49	(3)	10.00	76.00	200.00	110.00						38.00							
B-50	(3)	16.00	52.00	21.00	210.00						86.00							
B-51	(3)	9.60	1200.00	38.00	600.00						210.00							
B-52	(3)	190.00	91.00	17.00	340.00						110.00							
B-55	(3)	16.00	110.00	70.00	750.00						100.00							
B-56	(3)	21.00	220.00	39.00	200.00						100.00							
B-57	(3)	94.00	79.00	37.00	350.00						83.00							
B-58	(3)	550.00	250.00		660.00		2.40	47.00		1.00	120.00	0.20	0.13	1.30	12.00			
B-58	(4)	9.40	22.00	35.00	69.00						14.00							

## Groundwater Analysis

MW-3		<.05	<.020	2.20	0.07		<.005	<0.10		<.005	<.050	<.002	<.005	<.010		<.010	6.20	6.71
MW-3 Dup.		<.05	<.020	2.00	0.048		<.005	<0.10		<.005	<.050	<.002	<.005	<.010		<.010	-	
MW-4		<.05	<.020	0.08	0.02		<.005	<0.10		<.005	<.050	<.002	<.005	<.010		<.010	4.40	7.73
TB-7(ASTI)		0.86	0.99		2.60		4.10	5.10		0.05	1.80	0.0009	0.06	<.010				

 - exceeds Action Levels

(3) – Composite sample 2' & 5'

(4) – Sample depth is 8'

concentrations over the range limits established according to the proposed USEPA action levels/MDNR site-specific background calculated action levels/MDNR Erie glacial clay lobe soil survey. These constituents were:

- o Chromium = 280 mg/kg
- o Copper = 100 mg/kg
- o Zinc = 340 mg/kg
- o Lead = 120 mg/kg

Deeper samples analyzed from TB7 (9 to 11 feet and 14 to 16 feet) were all below the established action level ranges. Organics were also analyzed from the above three sample intervals in TB7 (see Table 5.14). All constituent concentrations were below detection limits.

Copper (100 mg/kg) and zinc (460 mg/kg) were over the action level ranges in TB8 from the 4- to 6-foot sample interval, with concentrations of lead (28 mg/kg) and mercury (0.33 mg/kg) falling between the action level ranges. No constituent concentrations were above or between the action level ranges in the 6- to 9-foot sample interval in TB8.

By April 1987, IPC had advanced six more soil borings in the lagoon area, of which two are more closely associated with the Lagoon No. 2 area (TB4 and TB5). Soil samples collected from the 4- to 6-foot interval were analyzed for chromium and copper only. All concentrations exceeded the action level range limits for the constituents analyzed (see Table 5.13, Lagoon No. 2, Soil Analytical Data).

The next IPC report, dated August 1987, was focused entirely on the Lagoon No. 2 area. Eleven soil borings were advanced in and around the area of the second lagoon (TB10 through TB20). These borings were only analyzed for chromium and copper. Higher constituent concentrations are associated with the north half of Lagoon No. 2. The action level range for copper was exceeded in the following samples:

- o TB11 (3 to 5 feet) = 71 mg/kg
- o TB12 (3 to 5 feet) = 160 mg/kg
- o TB13 (1 to 3 feet) = 950 mg/kg
- o TB14 (1 to 3 feet) = 74 mg/kg
- o TB16 (5 to 7 feet) = 130 mg/kg
- o TB20 (3 to 5 feet) = 68 mg/kg

Chromium concentrations over the action level ranges were measured in:

- o TB11 (3 to 5 feet) = 160 mg/kg
- o TB16 (5 to 7 feet) = 60 mg/kg
- o TB19 (1 to 3 feet) = 150 mg/kg

**TABLE 5.14**  
**VOLATILES GC/MS METHOD 8240**  
**TB-7**

Compound	Soils (mg/kg)			Groundwater (mg/L)
	(4-6')	(9-11')	(14-16')	
chloroform	< 0.40	< 0.40	< 0.40	< 4.0
bromodichloromethane	< 0.80	< 0.80	< 0.40	< 8.0
dibromochloromethane	< 0.80	< 0.80	< 0.80	< 8.0
bromoform	< 1.00	< 1.00	< 1.00	< 10.0
bromomethane	< 0.80	< 0.80	< 0.80	< 8.0
chloroethane	< 0.20	< 0.20	< 0.20	< 2.0
methylene chloride	< 0.40	< 0.40	< 0.40	< 4.0
trichlorofluoromethane	< 0.80	< 0.80	< 0.80	< 8.0
1,1-dichloroethene	< 0.20	< 0.20	< 0.20	< 2.0
chloromethane	< 0.50	< 0.50	< 0.50	< 5.0
1,1-dichloroethane	< 0.20	< 0.20	< 0.20	< 2.0
trans-1,2-dichloroethene	< 0.20	< 0.20	< 0.20	< 2.0
1,2-dichloroethane	< 0.20	< 0.20	< 0.20	< 2.0
1,1,1-trichloroethane	< 0.20	< 0.20	< 0.20	< 2.0
carbon tetrachloride	< 0.80	< 0.80	< 0.80	< 8.0
1,2-dichloropropane	< 0.20	< 0.20	< 0.20	< 2.0
trans-1,3-dichloropropene	< 0.20	< 0.20	< 0.20	< 2.0
trichloroethene	< 0.20	< 0.20	< 0.20	< 2.0
cis-1,3-dichloropropene	< 0.20	< 0.20	< 0.20	< 2.0
1,1,2-trichloroethane	< 0.20	< 0.20	< 0.20	< 2.0
2-chloroethyl vinyl ether	< 0.50	< 0.50	< 0.50	< 5.0
1,1,2,8-tetrachloroethane	< 0.20	< 0.20	< 0.20	< 2.0
tetrachloroethene	< 0.20	< 0.20	< 0.20	< 2.0
vinyl chloride	< 0.50	< 0.50	< 0.50	< 5.0
benzene	< 0.02	< 0.02	< 0.02	< 0.2
toluene	< 0.02	< 0.02	< 0.02	< 0.2
chlorobenzene	< 0.02	< 0.02	< 0.02	< 0.2
ethyl benzene	< 0.02	< 0.02	< 0.02	< 0.2
1,2-dichlorobenzene	< 0.04	< 0.04	< 0.04	< 0.4
1,3-dichlorobenzene	< 0.04	< 0.04	< 0.04	< 0.4
1,4-dichlorobenzene	< 0.04	< 0.04	< 0.04	< 0.4

samples received: 6/12/86

boring: TB-7, McDowell & Assoc.  
 IPC Report 4/87

TB18 from the 5- to 7-foot sample interval had a chromium concentration (53 mg/kg) that fell between the range limits.

In the January 1989 Techna Phase I report, only one soil boring was conducted in the area of Lagoon No. 2. This was B41 (see Table 5.13). Samples were analyzed from the 1-foot depth (TCLP analysis) and from the 1.0- to 2.5-foot interval for chromium, copper, nickel, zinc, antimony, arsenic, barium, beryllium, cadmium, lead, mercury, selenium, silver, and thallium (the TCLP analysis did not cover selenium, beryllium, or thallium). All constituent concentrations analyzed were below the action level ranges previously established in this work plan.

The Techna Phase II report (April 1989) consisted of 18 soil borings focusing on this area of the two lagoons. Six of the borings were more closely associated with Lagoon No. 2 (B44, B45, B55, B56, B57, and B58), than the five borings located midway between Lagoon No. 1 and Lagoon No. 2 (B46, B49, B50, B51, and B52), (see Figure 5.3). Both sets of soil borings will be assessed in this section. All the above borings were analyzed from composite samples from 2 and 5 foot depths, except for B44 and B58 which had a more inclusive analytical run on the samples collected at 8 feet.

The soil borings closest to Lagoon No. 2 in this Phase II investigation had zinc concentrations over the action level range limits in all six of the borings analyzed from the 2 and 5 foot composite samples. Five of the six borings (2 and 5 foot composite) had concentrations of copper over the action level ranges. The elevated concentrations for these two constituents are as follows:

<u>Zinc</u>	<u>Copper</u>
B44 = 100 mg/kg	--
B45 = 570 mg/kg	120 mg/kg
B55 = 750 mg/kg	110 mg/kg
B56 = 200 mg/kg	220 mg/kg
B57 = 350 mg/kg	79 mg/kg
B58 = 660 mg/kg	250 mg/kg

Concentrations of chromium exceeded the range limit in B45 (340 mg/kg), B57 (94 mg/kg), and B58 (550 mg/kg). Nickel concentrations fell between range limits in B44 (64 mg/kg) and B55 (70 mg/kg) from the 2 and 5 foot composite samples, and in the 8-foot sample from B44 (190 mg/kg).

Four of the five soil borings advanced in a north-south line between the two lagoons had elevated concentrations



(from the 2 and 5 foot composite sample) over the range limits for zinc, copper, and lead. These concentrations were as follows:

	<u>Zinc</u>	<u>Copper</u>	<u>Lead</u>
B49	110 mg/kg	76 mg/kg	38 mg/kg
B50	210 mg/kg	52 mg/kg	86 mg/kg
B51	600 mg/kg	1,200 mg/kg	210 mg/kg
B52	340 mg/kg	91 mg/kg	110 mg/kg

B52's chromium concentration (190 mg/kg) also exceeded the range limits for chromium. B49 had a nickel concentration (200 mg/kg) that was between range limits. All constituent concentrations in B46 (located halfway between the two lagoons) were below action level range limits.

#### 5.1.3 Perimeter Borings -- Closed Surface Impoundment Area

The most extensive amount of soil sampling data was generated in the Techna Phase I investigation which specifically dealt with the installation of soil borings around the perimeter of the facility property boundaries. Borings along the southern perimeter of the property, adjacent to the lagoon areas have assisted in the evaluation of the extent and nature of contamination in this area.

Four borings associated with the Techna Phase I investigation were advanced approximately 160-feet east of the lagoon area in the southeast corner of the property along a north-south line of chain link fence (B9, B10, B11, and B12), (see Figure 5.4, Perimeter Borings). Soil samples from these borings were composited from the 1.0- to 2.5-foot interval and the 3.5- to 5.0-foot interval. These samples were analyzed for chromium, copper, nickel, and zinc (see Table 5.15). B9 had concentrations of copper (140 mg/kg) and zinc (630 mg/kg) high enough to exceed the established action level ranges. B11 had a concentration of 69 mg/kg of copper which was above the action level range limit for copper. The other two borings (B10 and B12) were below range limits in all the constituents analyzed.

Six perimeter soil borings were advanced along the south property line approximately 40 to 60 feet from the south end of the lagoon area. Soil samples collected for analysis consisted of the 1.0 to 2.5 foot and 3.5 to 5.0 foot composited intervals (as above), with the same analytes as above (chromium, copper, nickel, and zinc). All of the samples had

DRAWING 9961A4-1 (FIG 5-4)  
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OHM CORPORATION  
FINDLAY, OHIO  
PLOT SCALE 1" = 1'

DRAFT 5-31

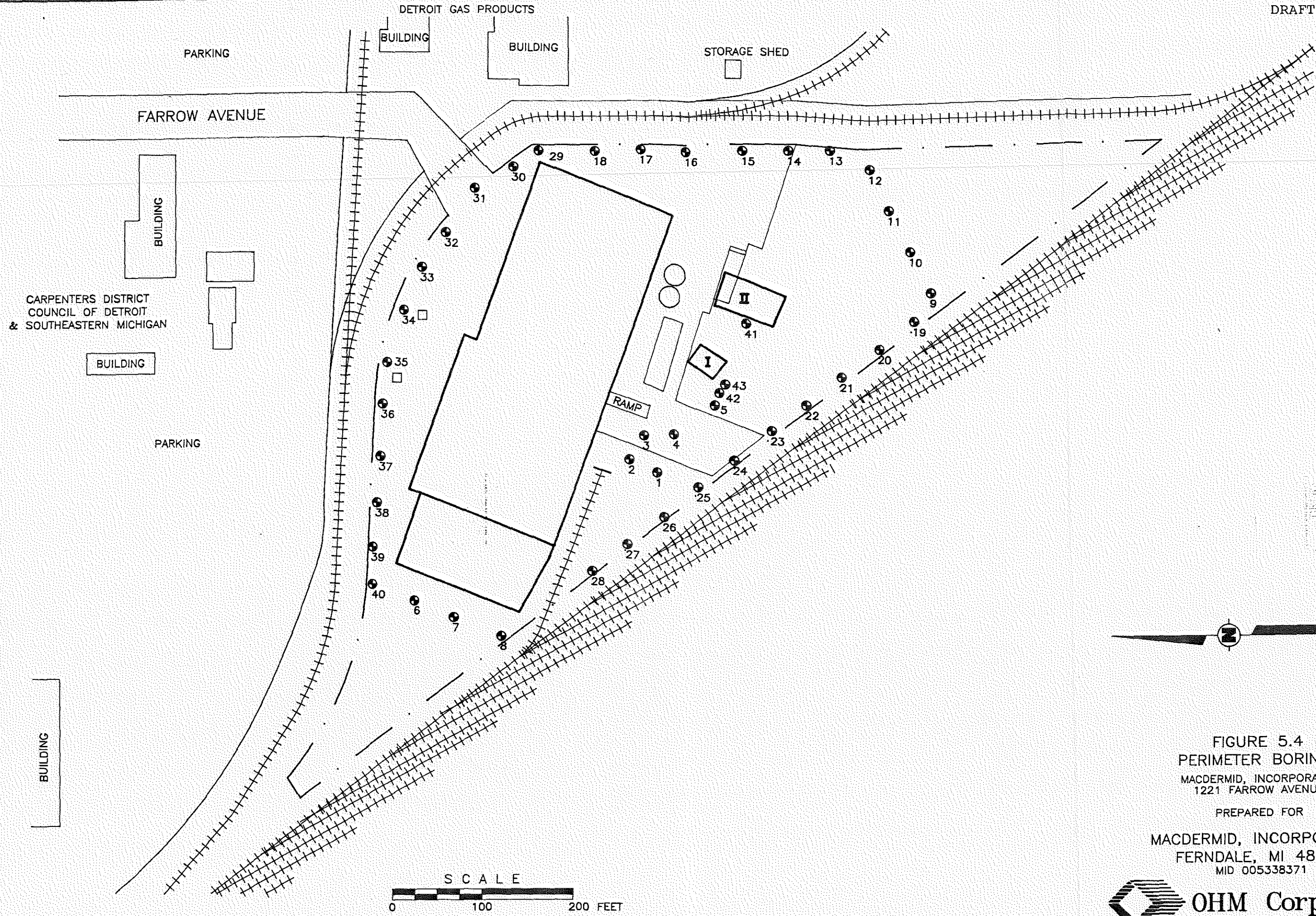


FIGURE 5.4  
PERIMETER BORINGS  
MACDERMID, INCORPORATED  
1221 FARROW AVENUE

PREPARED FOR  
MACDERMID, INCORPORATED  
FERNDAL, MI 48220  
MID 005338371



**TABLE 5.15**  
**PERIMETER BORINGS**  
**TECHNA PHASE I - METALS ANALYSIS (1/89)**  
(mg/kg)

Boring No.	Interval Sampled	Cr	Cu	Ni	Zn	Sb	As	Ba	Be	Cd	Pb	Hg	Se	Ag	Tl	pH
<b>Action Level Range</b>		41 - 57	29 - 41	42 - 2000	78 - 87		21 - 80	162 - 281		3.8 - 40	19 - 32	.14 - 20	.89 - 1.2	3.8 - 200		.5 - 2000
B-1 NS	(1)	310.00	27.00	6.50	32.00											
B-2 NS	(1)	11.00	120.00	14.00	550.00											
B-3 NS	(1)	130.00	48.00	28.00	340.00											
B-4 NS	(1)	16.00	160.00	38.00	780.00											
B-2,B-4	(2)	9.30	11.00	20.00	37.00											
B-5 L1	(1)*	0.04	0.08	1.30	2.40		<.005	0.60		0.04	0.28	<.002	<.005	0.02		9.65
B-5 L1	1' - 2.5'	14.00	19.00	24.00	110.00	12.00	0.10	47.00	0.40	0.90	23.00	0.06	0.01	0.60	7.00	
B-5 L1	3.5' - 5'	19.00	23.00	130.00	220.00	11.00	0.12	69.00	0.40	0.80	23.00	0.01	0.01	0.50	5.00	
B-5 L1	(2)	17.00	16.00	32.00	4.90											
B-6 IN	(1)	780.00	15.00	12.00	46.00											
B-7 IN	(1)	9.40	17.00	21.00	74.00											
B-8 NS/RI	(1)	3.30	50.00	9.00	17.00											
B-9	(1)	17.00	140.00	26.00	630.00											
B-10	(1)	7.00	10.00	15.00	38.00											
B-11	(1)	5.40	69.00	12.00	28.00											
B-12	(1)	9.90	14.00	14.00	50.00											
B-13	(1)	8.30	11.00	11.00	96.00											
B-7,B-13	(2)	7.70	11.00	18.00	38.00											
B-14	(1)	9.70	10.00	18.00	37.00											
B-15	(1)	7.80	10.00	17.00	35.00											
B-16	(1)	9.20	16.00	25.00	45.00											
B-17	(1)	11.00	15.00	15.00	46.00											
B-18	(1)	4.70	97.00	14.00	28.00											
B-19	(1)	11.00	91.00	26.00	510.00											
B-20	(1)	11.00	120.00	17.00	510.00											
B-21	(1)	6.10	56.00	18.00	97.00											
B-22	(1)	16.00	52.00	71.00	170.00											
B-23	(1)	7.50	140.00	14.00	650.00											
B-24	(1)	90.00	95.00	190.00	280.00											
B-23,B-24	(2)	8.60	8.20	15.00	33.00											

■ - exceeds Action Levels

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(1) - Composite from 1' to 2.5' & 3.5' to 5'  
(2) - Interval sampled for analysis from 6' to 7.5'  
\* - TCLP analysis

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2/26/91  
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**TABLE 5.15**  
**PERIMETER BORINGS (cont)**  
**TECHNA PHASE I - METALS ANALYSIS (1/89)**  
(mg/kg)

Boring No.	Interval Sampled	Cr	Cu	Ni	Zn	Sb	As	Ba	Be	Cd	Pb	Hg	Se	Ag	Tl	pH
Action Level Range		41 - 57	29 - 41	42 - 2000	78 - 87		21 - 80	162 - 281		3.8 - 40	19 - 32	.14 - 20	.89 - 1.2	3.8 - 200		.5 - 2000
B-25 NS/RR	(1)	230.00	9.20	11.00	31.00											
B-26 NS/RR	(1)	16.00	42.00	12.00	260.00											
B-27 NS/RR	(1)	6.90	12.00	17.00	37.00											
B-28 NS/RR	(1)	6.60	8.70	12.00	26.00											
B-29	(1)	7.10	6.90	14.00	29.00											
B-30	(1)	3.90	6.00	8.00	18.00											
B-31	(1)	14.00	7.90	17.00	38.00											
B-19,B-31	(2)	15.00	14.00	26.00	45.00											
B-32	(1)	12.00	14.00	16.00	36.00											
B-33	(1)	7.20	11.00	15.00	32.00											
B-33	(2)	6.70	11.00	17.00	38.00											
B-34	(1)	7.60	9.20	16.00	32.00											
B-35	(1)	13.00	11.00	15.00	36.00											
B-36	(1)	10.00	11.00	19.00	40.00											
B-37	(1)	9.30	9.30	19.00	41.00											
B-32,B-37	3.5' - 5'	11.00	15.00	25.00	43.00											
B-38	(1)	44.00	9.90	28.00	29.00											
B-39 IN	(1)	9.70	38.00	19.00	48.00											
B-40 IN	(1)	12.00	8.80	20.00	30.00											
B-41	(1)*	< 0.04	0.02	2.10	0.96		< 0.005	0.20		0.02	0.14	< 0.002	< 0.005	0.02		8.96
B-41 L1	1' - 2.5'	19.00	17.00	20.00	66.00	10.00	0.07	35.00	0.20	0.80	14.00	0.03	0.007	0.80	4.70	
B-42 L2	3.5' - 5'	9.20	5.60	10.00	25.00	7.20	0.05	24.00	0.10	0.50	6.30	0.02	0.02	0.20	2.30	
B-43 L2																

 - exceeds Action Levels

(1) - Composite from 1' to 2.5' & 3.5' to 5'

(2) - Interval sampled for analysis from 6' to 7.5'

\* - TCLP analysis



**TABLE 5.15**  
**PERIMETER BORINGS (cont)**  
**TECHNA PHASE II - METALS ANALYSIS (4/89)**  
(mg/kg)

Boring No.	Sample Depth	Cr	Cu	Ni	Zn	As	Ba	Cd	Pb	Hg	Se	Ag	Tl
Action Level Range		41 - 57	29 - 41	42 - 2000	78 - 87	21 - 80	162 - 281	3.8 - 40	19 - 32	.14 - 20	.89 - 1.2	3.8 - 200	
B-44	(3)	20.00	24.00	64.00	100.00				45.00				
B-44	(4)	9.70	10.00	190.00	33.00				16.00				
B-45	(3)	340.00	120.00		570.00	1.80	42.00	0.80	130.00	0.22	0.11	4.00	5.50
B-46	(3)	8.10	11.00	16.00	39.00				12.00				
B-47	(3)	42.00	110.00	94.00	650.00				100.00				
B-48	(3)	9.60	140.00	22.00	400.00				150.00				
B-49	(3)	10.00	76.00	200.00	110.00				38.00				
B-50	(3)	16.00	52.00	21.00	210.00				86.00				
B-51	(3)	9.60	1200.00	38.00	600.00				210.00				
B-52	(3)	190.00	91.00	17.00	340.00				110.00				
B-53	(3)	7.20	13.00	48.00	32.00				17.00				
B-54	(3)	10.00	210.00	110.00	720.00				170.00				
B-54	(4)	9.1	10	43	18.00				14.00				
B-55	(3)	16.00	110.00	70.00	750.00				100.00				
B-56	(3)	21.00	220.00	39.00	200.00				100.00				
B-57	(3)	94.00	79.00	37.00	350.00				83.00				
B-58	(3)	550.00	250.00		660.00	2.40	47.00	1.00	120.00	0.20	0.13	1.30	12.00
B-58	(4)	9.40	22.00	35.00	69.00				14.00				
B-59	(3)	31.00	55.00		24.00	2.50	68.00	2.00	80.00	0.15	0.14	0.60	6.50
B-59	(4)	56.00	200.00	760.00	2700.00				18.00				
B-60	(3)	110.00	200.00		370.00	2.50	64.00	0.80	100.00	0.24	0.09	0.60	7.20
B-60	(4)	7.90	17.00	43.00	52.00				18.00				
B-61	(3)	200.00	36.00	3700.00	210.00				30.00				
B-61	(4)	17.00	19.00	32.00	82.00				19.00				

 - exceeds Action Levels

(3) - Composite sample 2' & 5'

(4) - Sample depth is 8'

copper and zinc concentrations which exceeded the action level range limits. The copper and zinc concentrations were as follows:

	<u>Copper</u>	<u>Zinc</u>
B19	91 mg/kg	510 mg/kg
B20	120 mg/kg	510 mg/kg
B21	56 mg/kg	97 mg/kg
B22	52 mg/kg	170 mg/kg
B23	140 mg/kg	650 mg/kg
B24	95 mg/kg	280 mg/kg

The chromium concentration in B24 (90 mg/kg) was over the action level range, and the concentration of nickel (190 mg/kg) was between the range limits. B22 also had a nickel concentration within the range limit previously set.

One deep composite sample from both B23 and B24 at the 6.0- to 7.5-foot interval was analyzed in this area. Constituent concentrations in the sample were considerably lower than the action level range criteria established for purposes of site-specific comparison and evaluation.

## 5.2 SWMU NO. 2, UNITS THAT EMIT AIR CONTAMINANTS

This SWMU includes two distinct areas, the scrubber operations and the closed incinerator unit, which are described in the following subsections.

### 5.2.1 Scrubber Operations

At the MACDERMID Ferndale facility air emissions concerning the protection of human health and the environment have been continually undergoing evaluation and equipment upgrades. Initially, this facility operated a total of five scrubbers. These units were permitted according to air use Permit No. 614-86. In 1989, eight additional scrubbers were added to the facility operations. The original Permit No. 614-86 was voided and a Permit to Install No. 614-86A with general and special conditions was approved by the MDNR Air Quality Division on September 22, 1989. Notification has recently been given to the MDNR Air Quality Division concerning a scrubber change in the bulk silos area.

The four specifically designed areas of operation at the facility that require the use of air scrubbers are: the liquid mixing tank department which deals with the manufacturing of new liquid products and the recycling of spent MACDERMID products, the dry mix manufacturing department which handles dry material production (mixers) and packaging, the dry mix department which is concerned with the transfer of bulk dry raw materials from the silos to the blenders, and the dry mix silos which are used for bulk dry raw materials storage (see Figure 5.5).

DRAWING 9961A1-4(FIG5-5)

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PLOT SCALE: 1" = 1'

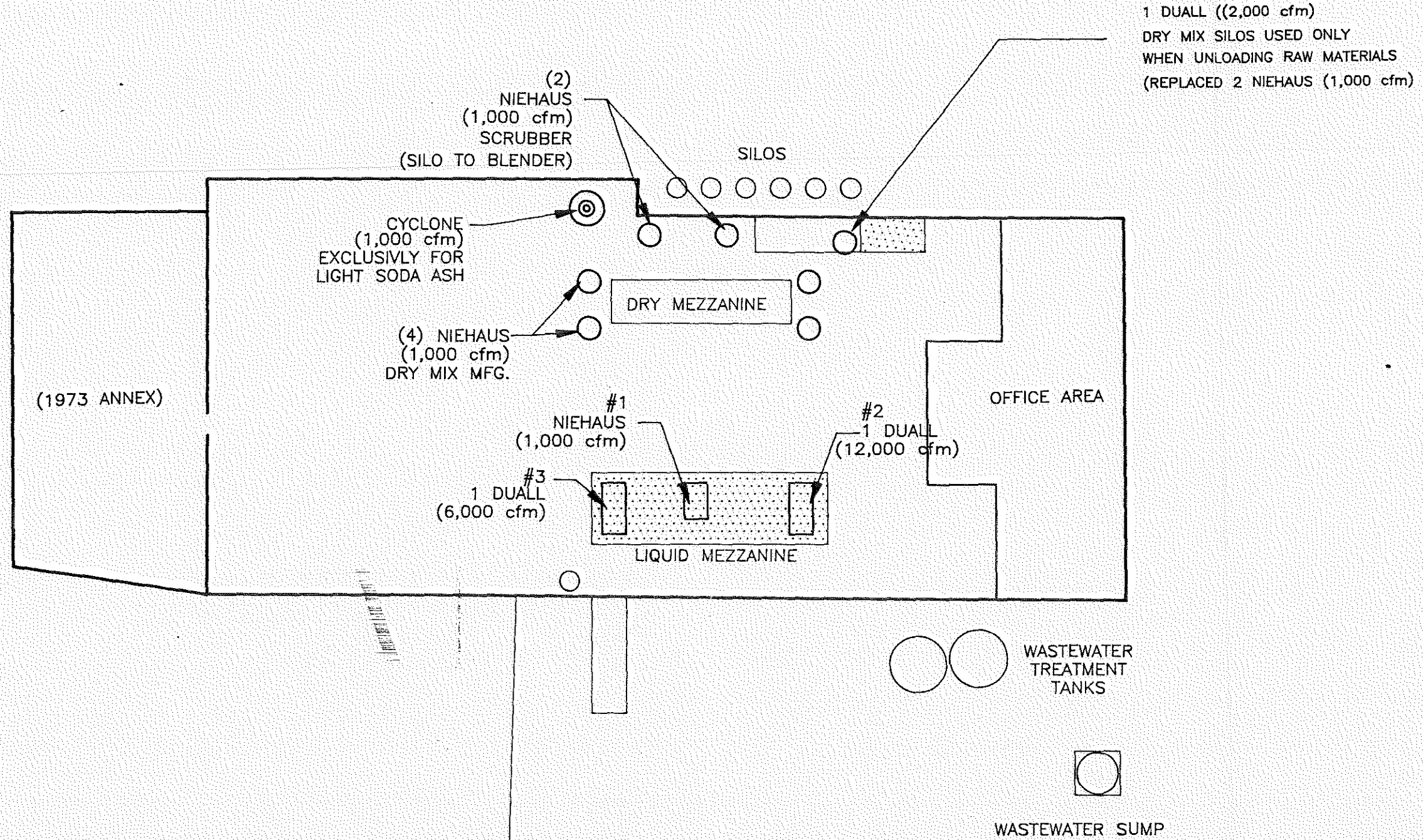
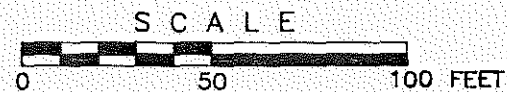


FIGURE 5.5  
SCRUBBER LOCATIONS  
MACDERMID, INCORPORATED  
1221 FARROW AVENUE

PREPARED FOR  
MACDERMID, INCORPORATED  
FERNDAL, MI 48220  
MID 005338371



#### 5.2.1.1 Liquid Mixing Department

##### Duall 6,000 CFM Scrubber

In the liquid mixing tank area, fume scrubber number 3 (see Figure 5.6) is a Duall 6,000 CFM unit. The model is a F-100 horizontal fume scrubber. This Duall scrubber was purchased by MACDERMID in August, 1973. It is located on the west side of the liquid mezzanine area. The 6,000 CFM Duall scrubber cleans the air of contaminated fumes associated with the two liquid recycling tanks (Tank Nos. 14 and 15). Refer to (Table 1, Liquid Mixing Tanks, in Appendix H) for a list of the liquid materials used in each tank. Figure 5.6 is a floor plan of the liquid mixing department area with corresponding tank numbers as given in Table 1, referenced above. The specifications of this scrubber are:

- o Constructed of PVC
- o 10 horsepower
- o Bed thickness = 12 inches
- o Water recycling flow rate = 18 gpm
- o Freshwater make-up = 0.9 gpm
- o 30 gpm with up to 5 gpm of make-up water
- o Distance from the property lines:
  - North line = 230 feet
  - South line = 185 feet
  - East line = 420 feet
  - West line = 200 feet
- o Ventilation = vertical/up
- o Discharge at roof
- o Stack height from grade = 31 feet, 8 inches with rain protection
- o Stack diameter = 18 1/4 inches

In 1984, MACDERMID purchased new packing for this scrubber and installed it themselves with Duall's assistance. There is no pH control system on this unit.

##### Air Emissions

Based on MACDERMID's description of their solder conditioner recycling process, OHM does not believe that there would be measurable releases into the air of any listed material as a result of the recycling operation, either as fugitive emissions or through the hood and scrubber system which vents on the facility roof. MACDERMID takes precautions to ensure that the waste that they accept for recycling is as represented. This is done through screening the recycle



PLOT SCALE: 1" = 1"

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NUMBER 9961F5-6

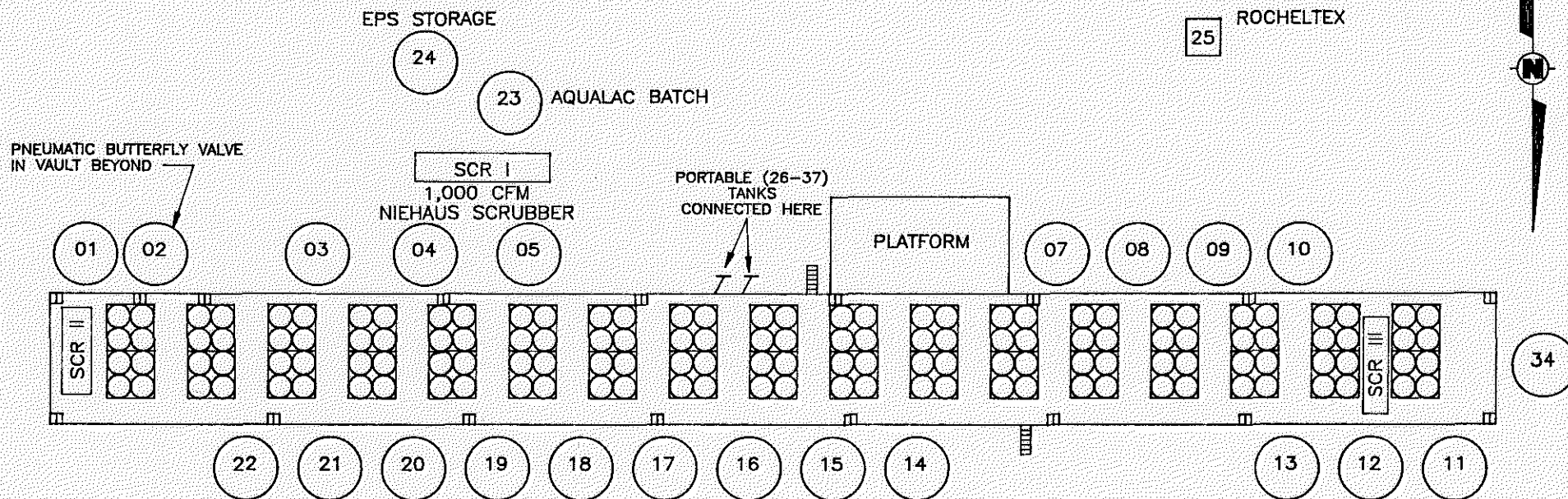


FIGURE 5.6

LIQUIDS DEPARTMENT SCRUBBER UNITS  
MACDERMID INCORPORATED  
FERNDAL, MICHIGAN

PREPARED FOR

MACDERMID, INCORPORATED  
FERNDAL, MICHIGAN  
MID 005 338 371

NOTES:  
LONGITUDINAL SECTION  
SCR II - SCRUBBER #II - 12000CFM - PVC - VERTICAL/UP - MIXING TANKS CONNECTED (01-03,06,24; 16-33,35,36) - DUALL  
SCR I - SCRUBBER #I - 1000CFM - S. STE - VERTICAL/UP - MIXING TANKS CONNECTED (04 & 05) - NIEHAUS.  
SCR III - SCRUBBER #III - 6000CFM - PVC - VERTICAL/UP - MIXING TANKS CONNECTED (07-15, 34) DUALL.



PLATFORM WITH SIMULATED HAZARDOUS WASTE  
STORAGE CAPACITY UNDER THE PLATFORM  
OF 12,000 GALLONS.



OHM Corporation

DRAFT 5-38

wastestreams by spot testing and through its policy of disposing of misrepresented materials as hazardous waste. The possibility does exist that materials sent to MACDERMID for recycling may contain organic contaminants of which MACDERMID is unaware. Therefore the assertion that measureable releases into the air of listed materials from waste recycle operations should be confirmed by source assessment sampling of the scrubber vent during normal operations.

#### 12,000 CFM Duall Scrubber

Scrubber No. 2 (see Figure 5.6), located on the east side of the liquid mezzanine area is a 12,000 CFM Duall scrubber. It was purchased in February 1985. Specifications pertaining to this unit are:

- o Constructed of PVC
- o 15 horsepower
- o Bed thickness = 12 inches
- o Water recycling flow rate = 36 gpm
- o Freshwater make-up = 1.8 gpm
- o 30 gpm with to 5 gpm of make-up water
- o Distance from the property lines
  - North line = 230 feet
  - South line = 150 feet
  - East line = 235 feet
  - West line = 360 feet
- o Ventilation = vertical/up
- o Discharge at roof
- o Stack height from grade = 33 feet with rain protection
- o Stack diameter = 24 1/4 inches

This scrubber is used in the production phase associated with the liquid products manufactured by MACDERMID. The air filtration systems on Duall Scrubber Nos. 2 and 3 can be joined together or partially by-passed with the use of dampers or baffles in the columns according to needed efficiency and the redirection of air flow.

A letter from MACDERMID to the Air Quality Division of the MDNR, dated November 29, 1990, stated that modifications have been made to this fume scrubber so that during the process of unloading from the tanker trucks to the bulk storage tanks nitric acid and ammonium hydroxide vapors can be vented into this scrubber.

### 1,000 CFM Niehaus Scrubber

In the liquid mixing tank area, Fume Scrubber No. 1, also located in the liquid mixing tank areas (see Figure 5.6), is a 1,000 CFM Niehaus unit. It is located in the center of the liquid mezzanine area and is dedicated to the ventilation of the two liquid phosphorous mixing tanks (i.e., Tank Nos. 04 and 05). Specifications associated with this scrubber are as follows:

- o Constructed of stainless steel
- o 5 horsepower
- o 6 gpm = maximum flow rate
- o Distance from the property lines:
  - North line = 230 feet
  - South line = 170 feet
  - East line = 270 feet
  - West line = 390 feet
- o Ventilation = vertical/up
- o Discharge at roof
- o Stack height from grade = 34 feet, 1 inch
- o Stack diameter = 8 inches

#### 5.2.1.2 Dry Mix Manufacturing Department

There are a total of four 1,000 CFM Niehaus scrubbers in use inside the building on the north side in the dry mix manufacturing department. These scrubbers are used for particulate control.

Scrubbers 1-A and 1-B are located on the mezzanine level in the dry mix manufacturing department. These two scrubbers (1-A and 1-B) are used in the production process with mixers 1 and 2, respectively. Scrubber 2-A and 2-B are located on the main floor. They are used for packaging in association with mixers 1 and 2 (see Figure 5.7). Specifications are as follows concerning these four 1,000 CFM Niehaus Scrubbers:

- o Constructed of carbon steel
- o 5 horsepower
- o 6 gpm = maximum flow rate
- o Distance from property lines:

	<u>1-A</u> <u>(feet)</u>	<u>1-B</u> <u>(feet)</u>	<u>2-A</u> <u>(feet)</u>	<u>2-B</u> <u>(feet)</u>
North line	120	120	120	120
South line	270	270	270	270
East line	260	240	260	240
West line	400	420	400	420

PLOT SCALE: 1" = 1"

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FINDLAY, OHIO

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NUMBER 9961F5-7

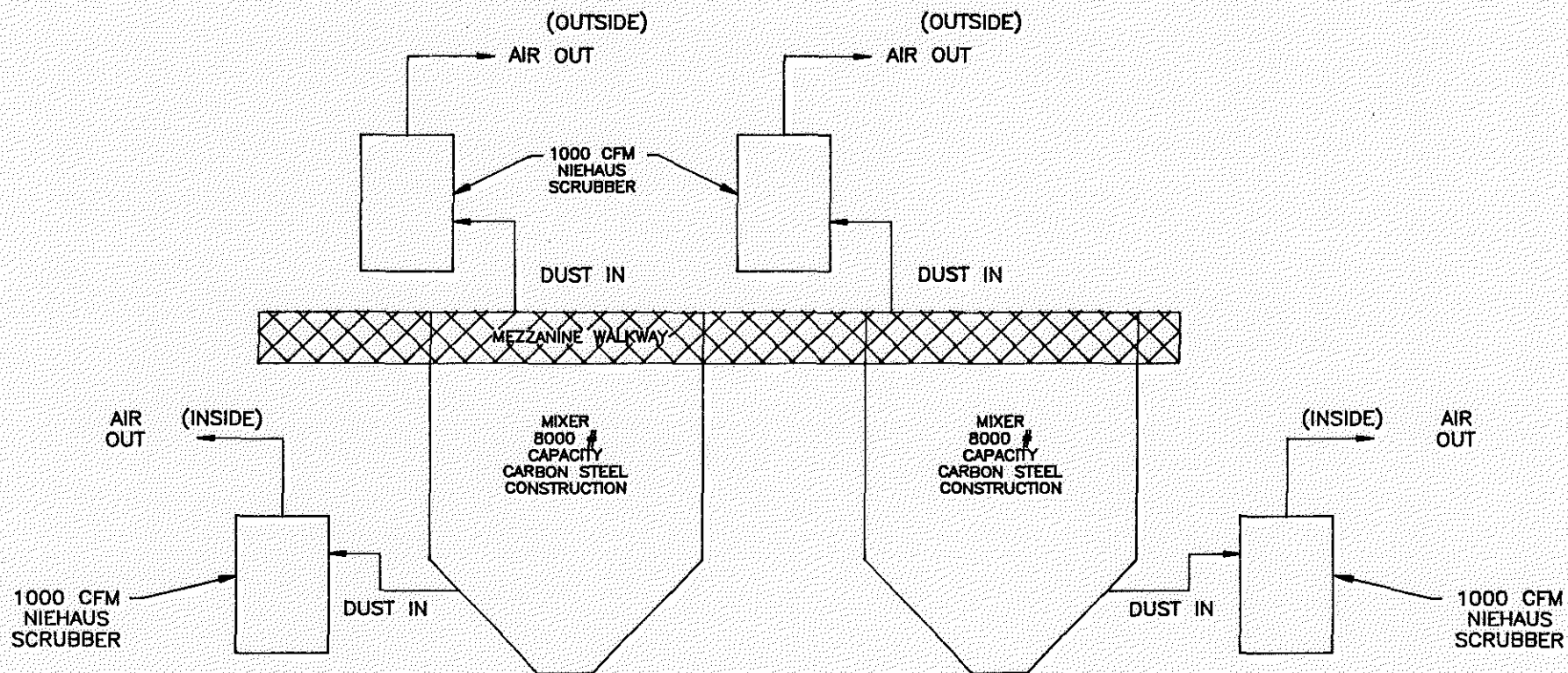


FIGURE 5.7

DRY MIX MANUFACTURING DEPARTMENT  
(SIDE VIEW)

MACDERMID INCORPORATED  
FERNDAL, MICHIGAN

PREPARED FOR

MACDERMID INCORPORATED  
FERNDAL, MICHIGAN

MID 005 338 371



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DRAFT 5-41



See Table 5.16 for a list of the raw materials in the Dry Mix Manufacturing Department.

#### 5.2.1.3 Dry Mix Department

##### 1,000 CFM Cyclone Scrubber

One 1,000 CFM Cyclone scrubber is used in the Dry Mix Department solely for the transfer of bulk soda ash (see Figure 5.8). The soda ash is such a light fine dust that this scrubber works particularly well with this type of material. The Cyclone scrubber is located on the floor along the inside of the north wall. Specifications of the Cyclone scrubber are as follows:

- o 6 gpm = maximum flow rate
- o Distance from the property lines:
  - north line = 116 feet
  - south line = 286 feet
  - east line = 260 feet
  - west line = 400 feet
- o Ventilation = vertical/down
- o Discharge at the north wall; outside
- o Stack height (from grade) = 4 feet, 8 inches with rain protection
- o Stack diameter = 8 inches

##### Two 1,000 CFM Niehaus Scrubbers

Two 1,000 CFM Niehaus particulate scrubbers (No. 6 east and No. 5 west) are located inside the building along the north wall (see Figure 5.8). They are used when transferring dry materials for bulk production and are part of the dry mix department. The specifications on these scrubbers are:

- o Constructed of carbon steel
- o 5 horsepower
- o August 3, 1988
  - 6 gpm = maximum flow rate
- o Distance from the property lines:
  - North line = approximately 120 feet
  - East line = approximately 260 feet
  - West line = approximately 400 feet
- o Ventilation = vertical/down
- o Discharge at wall

TABLE 5.16

RAW MATERIALS IN  
DRY MIX MANUFACTURING DEPARTMENT

<u>Mixer No.</u>	<u>Capacity (lbs.)</u>	<u>Product Code</u>	<u>Annual Usage (lbs.)</u>	<u>Components (Raw Material)</u>
1	9,600			
2	6,400			
		19063	10,000	Sodium hydroxide sulfate
		19155	5,300	Ammonium chloride
		19208	6,400	Stannous chloride Thiourea
		19293	2,700	Sodium hydrogen sulfate
		19369	60,800	Oxalic acid
		19801	2,575	Iodides Sodium bisulfate
		79928	25,200	Sodium hydroxide
		79975	2,800	Sodium cyanide Sodium hydroxide

PLOT SCALE: 1" = 1"

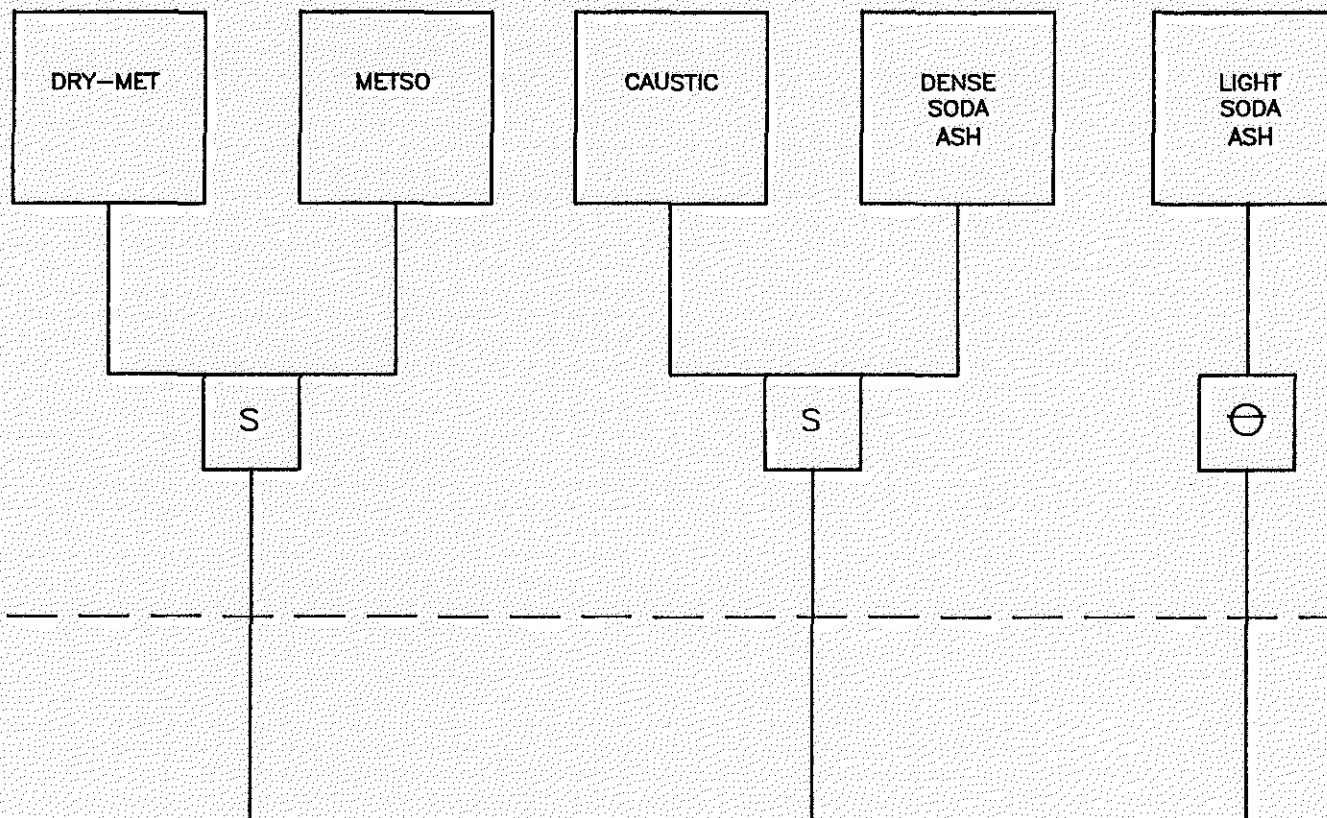
OHM CORPORATION  
FINDLAY, OHIO

DRAWN BY  
L. DUHIGG 2-11-91

CHECKED BY

APPROVED BY

DRAWING  
NUMBER 9961F5-8



LEGEND:

S = 1,000 CFM NIEHAUS SCRUBBERS WITH OUTSIDE DISCHARGE.

⊖ = 1,000 CYCLONE SCRUBBER WITH OUTSIDE DISCHARGE.

FIGURE 5.8

DRY MIX DEPARTMENT  
MACDERMID INCORPORATED  
FERNDAL, MICHIGAN

PREPARED FOR

MACDERMID INCORPORATED  
FERNDAL, MICHIGAN  
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- o Stack height (at grade): 19 feet, 3 inches with rain protection
- o Stack diameter: 8 inches

See Table 2 in Appendix A for a list of raw materials used in the Dry Mix Tanks.

#### 5.2.1.4 Dry Mix Silos

This 2,000 CFM Duall scrubber is a particulate scrubber used when unloading dry bulk raw materials into the dry bulk storage silos (see Figure 5.9). Dry bulk materials are labeled on the silos on Figure 5.9. These six silos are made of carbon steel and are located along the north side of the building. Specifications on this scrubber unit are:

- o Constructed of PVC
- o Bed thickness = 4 inches
- o 30 gpm = water flow rate
- o Make-up water runs through
- o Distance from the property lines:
  - North line = approximately 110 feet
  - East line = approximately 240 feet
  - West line = approximately 420 feet
- o Ventilation = vertical/down
- o Discharge at the wall; outside
- o Stack height at grade = 2 feet, 2 inches with rain protection
- o Stack diameter = 16 inches

The scrubber system on the dry bulk silos was modified recently. Originally, a 500 CFM Duall scrubber was used on the GBS (sodium bisulfate) silo. Two 1,000 CFM Niehaus scrubbers (in series) and a 2,000 CFM Duall scrubber were used on the remaining five dry bulk products stored in the silos. The 500 CFM Duall and the two 1,000 Niehaus scrubbers (in series) were removed. The remaining 2,000 CFM Duall scrubber was upgraded to handle particulate emissions from all six dry bulk product silos. The Air Quality Division of the MDNR was notified concerning these scrubber modifications in a letter from MACDERMID, dated November 29, 1990.

#### 5.2.2 Closed Incinerator Unit

##### 5.2.2.1 Permit and Historical Background

The only remaining physical evidence of the existence of this incinerator, which was initially located on the north-northwest corner of the building, is the old concrete pad



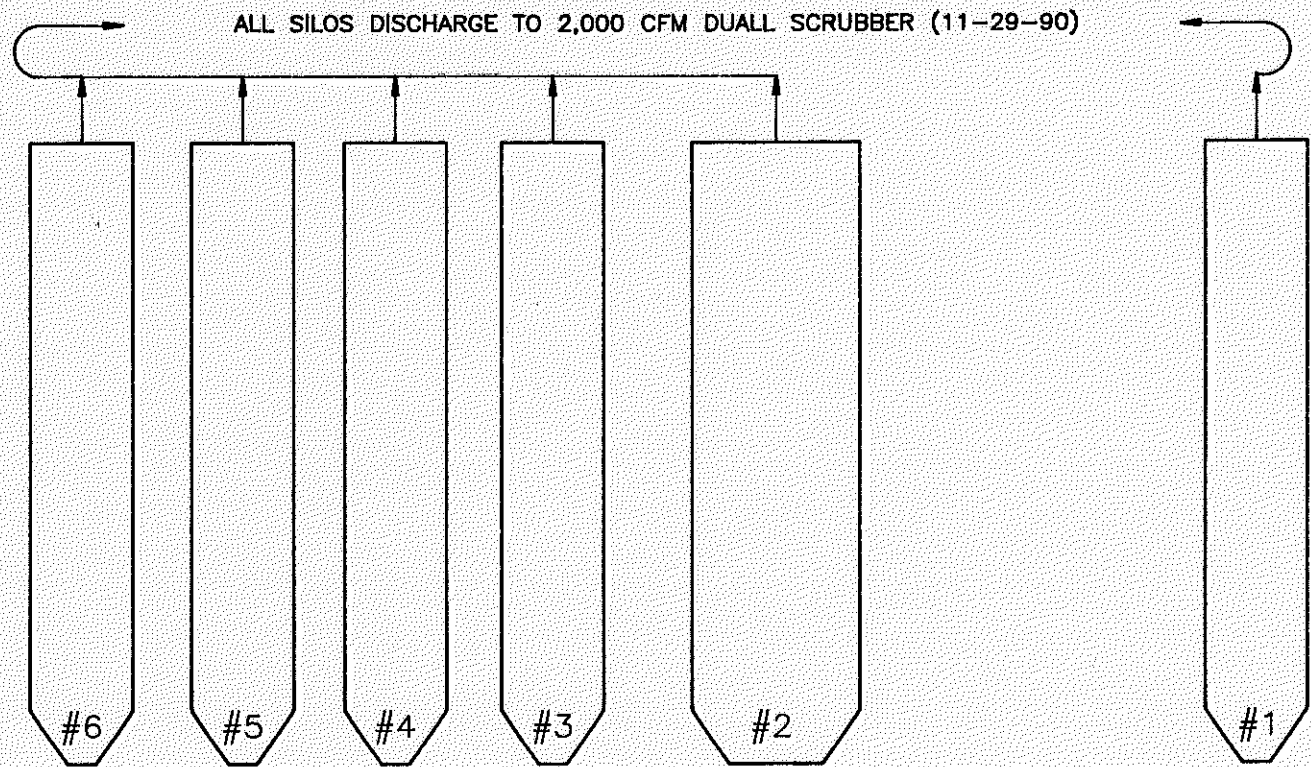


FIGURE 5.9

DRY MIX SILOS  
MACDERMID INCORPORATED  
FERNDAL, MICHIGAN

PREPARED FOR

MACDERMID INCORPORATED  
FERNDAL, MICHIGAN  
MID 005 338 371



OHM Corporation

#6	#5	#4	#3	#2	#1
80,000 lbs. DRYMET = SODIUM METASILICATE-- ANHYDROUS	80,000 METSO = SODIUM METASILICATE-- PENTAHYDRATE	80,000 lbs.  SODIUM HYDROXIDE	80,000 lbs.  DENSE SODA ASH	100,000 lbs.  LIGHT SODA ASH	80,000  SODIUM BISULFATE

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area in the driveway area. This pad is approximately 25 feet from the corner of the building. The dimensions are approximately 6 by 9 feet. The concrete is extensively cracked in this area at present. The incinerator can be vaguely discerned in a 1969 (spring) aerial photo of the site which was available from the Oakland County Planning Commission. A shadow from the stack can be observed in this photo amongst a variety of staged drums and containers that were stored in that area at the time.

The first recorded evidence of the incinerator at the MACDERMID Ferndale facility was on an application to the Michigan Department of Health Air Pollution Control Commission on September 12, 1973, for the notification and/or approval that the equipment had been altered on August 16, 1973 (Permit No. 89-73I). On the application, the date of June 27, 1967, was given as the date initial construction of the incinerator was completed. The alteration consisted of the addition of a secondary burner. Coincident with this addition of a burner, the location of the incinerator was moved to the south side of the building, east of the presently concrete ramp area (see Figure 5.1, SWMU Location Map).

The incinerator was a Plibrico, Model SM-600 with a (maximum) capacity given on the permit (No. 89-73I) as 600 pounds per hour. All later documentation (AP-101, AP-21, AQ-20) shows the capacity as 300 pounds per hour. According to Permit No. 89-73I, the Plibrico incinerator was a Class III, direct-fired incinerator used for burning 100 percent trash (i.e., type 0) which is broken down as 0 to 5 percent inert waste, 0 to 10 percent is the moisture of the waste, the heating value being equal to 8,500 Btu/pounds with the capacity burning rate of the waste ranging from 100 or more pounds per hour. This trash can be more site-specifically described as being mostly cardboard drums and a few plastic liner bags.

#### 5.2.1.2 Equipment Specifications

The Plibrico incinerator is a multiple chamber incinerator. Specifications pertaining to the primary chamber are as follows:

- o Volume = 79.5 cubic feet
- o Effective grate/hearth area = 20.25 square feet
- o 100 percent excess air; adjustable
- o Total heat release = 25,000 Btu/hr/cubic feet
- o 70 percent air is applied as overfire air
- o 30 percent air is underfire

Specifications of the secondary combustion chamber are the following:

- o Volume = 50.7 cubic feet
- o Gas velocity = 13.7 feet per second (max.)

- o Maximum temperature is 1,400 degrees Fahrenheit
- o Estimated holding time of gas is 0.202 seconds

Both the primary and secondary burners are power, each with a capacity of 800,000 Btu/hour.

The dampers are associated with the stack and are barometric and positive (slide). Air pollution control equipment consists of a spark arrestor and a stack. Specifications concerning the stack are:

- o Steel/lined
- o Inside diameter = 22 inches
- o Height above grade = 31 feet, 6 inches
- o Height of the building on the side is 23 feet, 9 inches and at the top of the roof peak (center of building) the roof is 31 feet high
- o Distance to the nearest obstruction = 150 feet (no fan is used)
- o Outdoor installation -- open air

Modifications to this incinerator consist of the primary and secondary burners. The manufacturer of this incinerator has provided an estimate of emissions loading to be 0.10 pounds per 1,000 pounds of gas, however, no test data is available to reinforce this figure.

#### 5.2.2.3 Equipment Tracking Forms

A 1973 Incinerator Form AP-101, under establishment number A-9805 was completed with the following information. The incinerator was described as open burning. It was used for burning general waste described as paper, cardboard, and general trash at a rate of 250 cubic yards per day. Other materials burned were listed as ten 20-gallon plastic bags per day. The capacity of this multiple chamber incinerator is now and from this point on given as 300 pounds per day. During 1973, the incinerator was operated 250 days. The secondary burner was reportedly installed in 1973. A screen (no further description available) was given as the flyash control equipment on the incinerator at this time.

A 1974 Source Data Report was reviewed by MACDERMID. This AP-21 Incinerator Form gives the information that was available on this piece of equipment in 1973, so that it can be updated for 1974. All information remained the same as that given on the 1973 AP-101 with the exception of flyash

control which was given as "none." Additional information on this form which was not included on the previous document consisted of a source ID No. 21001 and a waste burning schedule broken down into 8 hour per day increments for 250 days per year.

The AQ-20 Equipment Identification Form presented 1983 incinerator data very similar to what was previously given on the AP-101 and the AP-21 forms. A total yearly capacity was listed as 3,462.5 tons per year based on a 300 pounds per hour capacity. The 1984 update and/or revision portion of this form stipulated that this equipment was not operated in 1984 and the incinerator was discontinued.

#### 5.2.2.4 Equipment Inspections

Further documentation that corresponds to the incinerator equipment history are the facility incinerator inspections that were conducted by the MDNR. The first reported site investigation pertaining on the incinerator was on March 3, 1976. All equipment was in order and operating properly at that time under the "Incinerator Operation Guidelines" by the MDNR.

An inspection of the incinerator on December 29, 1980, by the MDNR found items associated with the incinerator in need of repair and the need for proper practices to be put into effect concerning the maintenance and up-keep of this piece of equipment. The requirements were as follows:

- o Renovate the burning chamber bricks; they are badly spalled
- o Install a new spark arrestor; the original one is torn
- o Install a new barometric damper; it is missing
- o Clean the grate and ash collector and implement a regular maintenance program; the grate and ash collector were full of burnt rubbish at the time of the inspection
- o Reconstruct the exhaust stack; it is badly rusted.

In response to these items requiring repair, MACDERMID requested price quotes for the repairs versus a new incinerator. The following contractors replied: Incinerator Service and Parts on February 3, 1981, and George McIntosh, Inc. on February 6, 1981. Standard Disposal Services, Inc. (SDS) was also contacted by MACDERMID for pricing concerning a 2 cubic yard trash compactor and monthly haul-off and disposal of nonhazardous waste receiver box. This quote was delivered by



SDS on March 20, 1981. SDS sent MACDERMID a quote on a 1/2 cubic yard McClains trash compactor unit and updated hauling and disposal rates of nonhazardous waste in the receiver box.

In March 1981, an internal (MACDERMID) request to purchase and install the 1/2 cubic yard McClain trash compactor was approved, plus funds for a 220 volt power supply. On August 3, 1981, a request to provide equipment and labor to dismantle the existing incinerator was approved at MACDERMID. Following that action, the MDNR permit to construct and operate an incinerator (Permit No. 89-73I) was voided on June 27, 1988, because the equipment had been removed.

#### 5.2.2.5 Incinerator ISCLT Air Modeling

OHM has modeled the effect of the smoke plume from MACDERMID's trash incinerator using USEPA's Industrial Source Complex Long Term (ISCLT) computer model running in the PCGEMS system. The program was run in concentration mode with a source mass flux of 1 gram per second. OHM ran the model using the U3 (urban) dispersion coefficient and the regulatory default mode. The meteorological data was taken from the Detroit City airport during the 5-year period 1969 to 1974. This was the data available in PCGEMS from the Stability Array (STAR) weather station closest to the site. The purpose of the modeling, as suggested by Mardi Klevs of USEPA, Region V, was to indicate areas of possible soil contamination due to the operation of the incinerator.

MACDERMID operated its trash incinerator at two different locations through the years. The first location was just off the northwest corner of the building (the original building not the annex). The second location was on the southeast corner of the concrete pad which lies due south of the building. The incinerator was operated at the first location during the years 1969 to 1973. It was moved late in 1973 to the second location as work on the annex began. It was in operation there from 1973 to 1981, when it was replaced by a trash compactor.

OHM ran the ISCLT model for each location. The receptor grid used and the ten highest concentrations for each model run are indicated on site plans: Figure 5.10 for the first location and Figure 5.11 for the second. The detailed model input and output for each run are included in Appendix I.

For the first location, the area of highest plume concentration was an area on the MACDERMID property southeast of the incinerator. The area of highest plume concentration associated with the second incinerator was east of the incinerator on the MACDERMID property and substantially overlaps the location of the old lagoons.

DRAWING 9961A1-2(FIG5-10)  
NUMBER  
APPROVED BY  
CHECKED BY  
DRAWN BY  
C.E. MERRIN 1-30-91  
OHM CORPORATION  
FINDLAY, OHIO  
PLOT SCALE: 1" = 1'

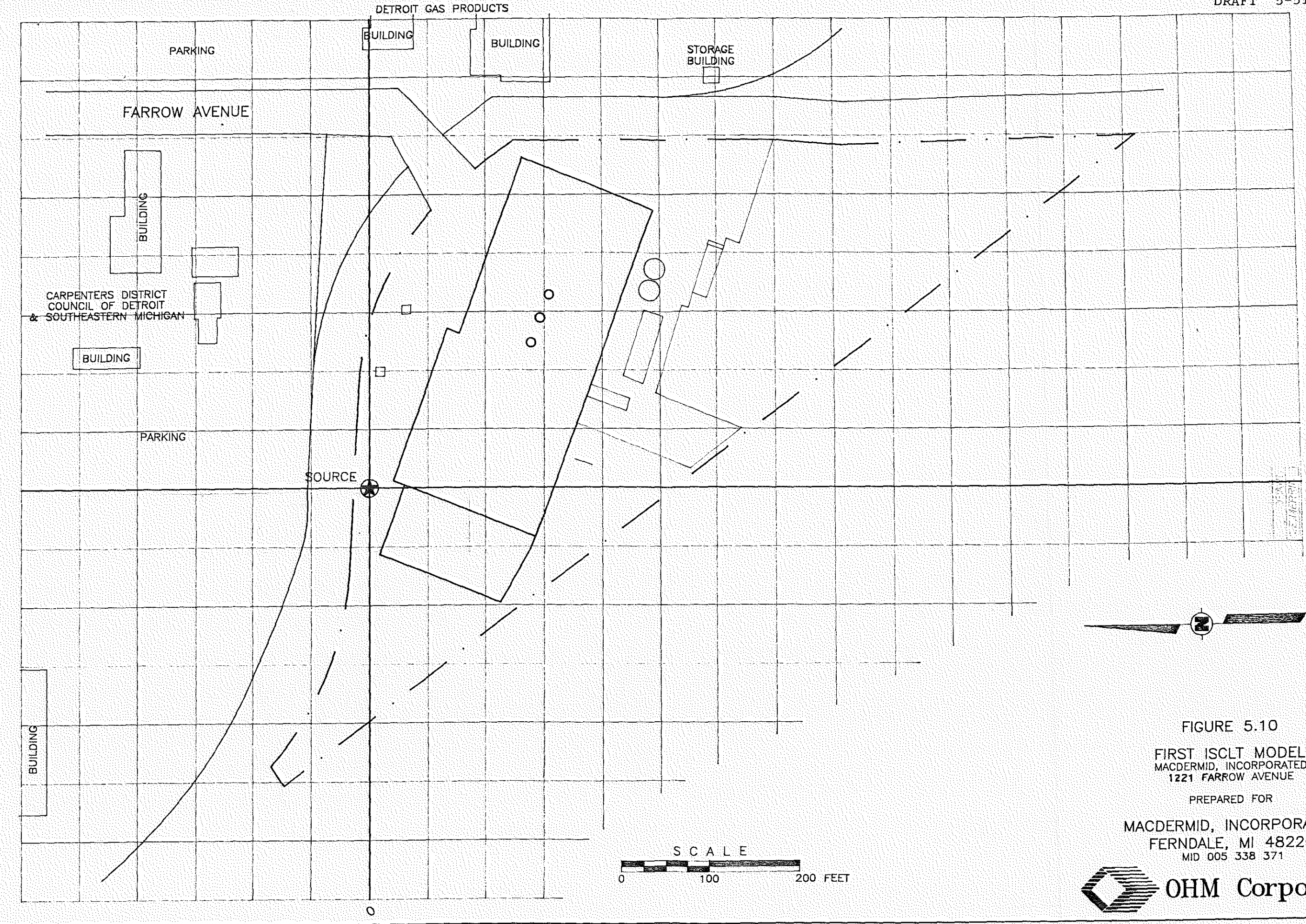
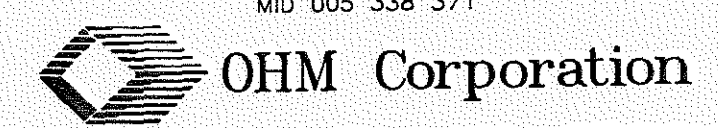


FIGURE 5.10  
FIRST ISCLT MODEL  
MACDERMID, INCORPORATED  
1221 FARROW AVENUE

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MACDERMID, INCORPORATED  
FERNDAL, MI 48220  
MID 005 338 371



DRAWING 9961A1-2(FIG5-11)  
NUMBER

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CHECKED BY

DRAWN BY  
C.E. MERRIN 1-30-91

OHM CORPORATION  
FINDLAY, OHIO

PLOT SCALE: 1" = 1'

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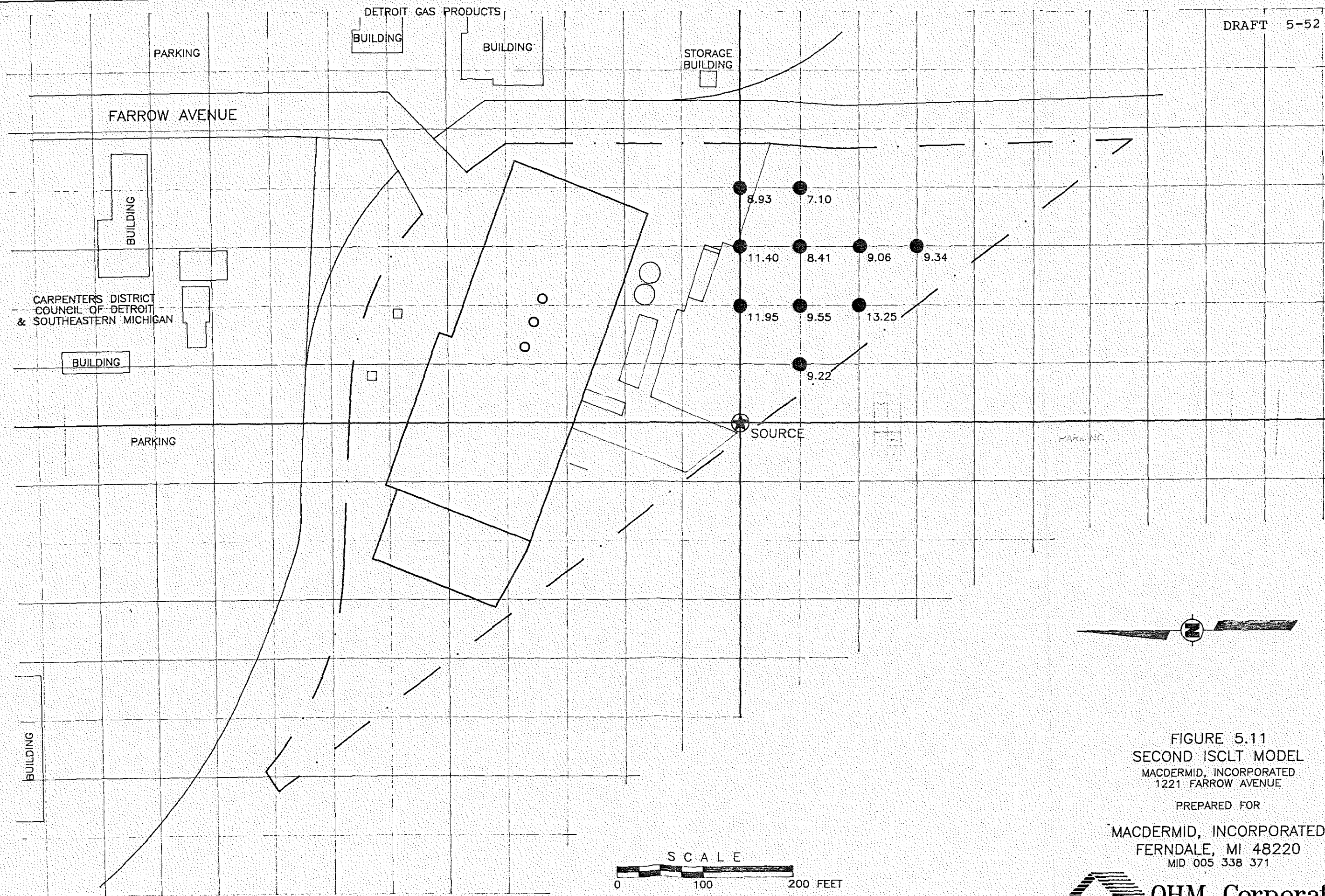
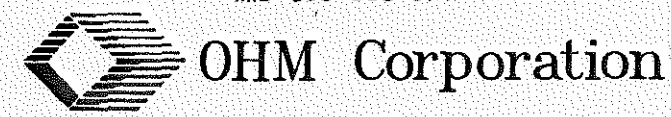


FIGURE 5.11  
SECOND ISCLT MODEL  
MACDERMID, INCORPORATED  
1221 FARROW AVENUE

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#### 5.2.2.6 Analytical Data

Borings done in conjunction with the Techna Phase I (report dated January 1989) perimeter soil sampling that are possibly related to the original incinerator location are: B6, B7, and B8 to the south of the first location, and B39 and B40 to the north (see Figure 5.3). All soil samples collected from these borings were analyzed from the composited sample intervals of 1.00 to 1.25 feet and 3.5 to 5.0 feet.

In the borings to the south of the old incinerator location, chromium (780 mg/kg) exceeded the previously established action level range limit in B6 (see Table 5.15). B8, located between SWMU Nos. 2 and 3, had a high copper concentration (50 mg/kg) which exceeded the range limit set.

The two borings to the north of this initial incinerator location (B39 and B40) had no constituent concentrations over the given action level range limits. However, in B39, copper concentrations (38 mg/kg) were between range limits.

In 1973, the incinerator was moved to approximately the middle of the south side of the building, east of the concrete ramped area. Constituents concentrations associated with the incinerator emissions at this second location would be difficult to distinguish from other sources of contamination in this area such as: the closed surface impoundment area (SWMU No. 1) and the railroad spur and associated concrete ramped area (SWMU No. 3).

#### 5.3 SWMU NO. 3, INACTIVE RAILROAD SPUR AREA

The overall area associated with the SWMU No. 3 involves approximately 4,000 square feet. It is a pie-shaped area adjacent to the south side of the manufacturing building (see Figure 5.1). This railroad spur is a single train track located along the south side of the MACDERMID building, starting at the west corner and extending eastward, parallel to the building, for approximately 160 feet. The spur branches off of the main Grand Trunk Railroad system adjacent to the south side of the property. It was used to receive goods, but not to transport any materials or products from the facility.

The records of incoming supplies begin in July 1968 and continue through October 1981. A significant decrease in the number of shipments received and the number of railroad cars coming into the facility per year started in 1979. Prior to 1979, there were an average of 42 shipments received per year with an average of 44 railroad cars per year. Most shipments only consisted of one railroad car.



A list of 25 vendors used the railroad spur during the 13-year use (see Table 5.17). Products received included borax, boric acid, filter powder (diatomaceous earth), drums (clean/new), containers (clean/new), sodium chloride, cere-lose (sugar), phosphates (SCD fluoride and SCD bifluoride), caustic potash, and soap.

Since the end of 1981, this railroad spur has been inactive. Plans are nearly complete to start construction for a new, upgraded hazardous-waste storage area in this general location. Most of the construction will be towards the east end of the old spur, just west of the concrete ramped area already present.

#### 5.3.1 Inactive Railroad Spur Area -- Soil Sampling and Analytical Data

Soil borings were advanced on two sides (east and south) of this area during the Techna Phase I investigation (report dated January 1989) (see Figure 5.4, Perimeter Boring Locations). All borings were analyzed from samples composited from 1.0 to 2.5 foot and 3.5 to 5.0 foot sample intervals. The analytes were chromium, copper, nickel, and zinc. The borings on the south side of this area were B25, B26, B27, B28, and B8 (to the far southwest end of the spur).

B26 had concentrations of copper (42 mg/kg) and zinc (260 mg/kg) which both exceeded the previously established action level ranges for these constituents (see Table 5.15). The chromium concentration (230 mg/kg) in B25 was over the range limit. In B8, to the far southwest of the SWMU area, but close to the west end of the railroad spur, high concentrations of copper were detected (50 mg/kg) and found to be over the range limits. B27 and B28 had no constituent concentrations high enough to exceed any of the assigned action level ranges.

On the east side of this SWMU, adjacent to the concrete ramped area where clean carboys and clean stainless steel drums are stored, B1 and B2 were augered and sampled. Copper (100 mg/kg) and zinc (550 mg/kg) concentrations measured from the composite 1.0 to 2.5 foot and 3.5 to 5.0 foot sample interval in B2 exceeded the action level ranges. Chromium was above the range limit in B1. Thirty to 40 feet east of B1 and B2 were B3 and B4, respectively. These borings were advanced in the ramp/clean container storage area. B3 had elevated concentrations of chromium (130 mg/kg), copper (48 mg/kg), and zinc (340 mg/kg), which were all over the action level range limits. Zinc (780 mg/kg) and copper (160 mg/kg) were over the action level ranges in B4.

These higher concentrations in B3 and B4 are probably associated with a previous washing station. A liquid stream can be detected in this area in aerial photographs provided

TABLE 5.17: LIST OF VENDORS USING RAILROAD SPURS

VENDORS	YEAR SHIPMENT(S) RECEIVED													
	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
American Pot & Chemical	6	4												
Armour & Co.	1													
CCA		2	1					22	22	25	17			
Chemcentral													3	1
Container Corp. of America	2	11	10	5	10	15	26						1	
Corn Industrial (CPC)	4	4	3	2	4	3	4	1						
Diamond Shamrock	2	1	2	1	3	4								
Dicalite (Brown Co.)	3	4	5	1	2	8	9							
Dicalite (Grefco)	4		2	6	7			2	1	2	1			
E.I. DuPont	9	3	3	2	3	3								
Fiber Sales & Development		5	1											
Grief, Bros.			4					4	5	1				
Hedwin	12	8	11	2										
Inland Steel	5		1											
International Minerals & Chemicals	1	1	2											
Johns Manville								1	2	4	3			
Matteson Ridolfi		2		1										
McKesson Chemical	1													
Monsanto	3	1												
Nolwood Chemical			2	2	4									
Rheem	2		6	7	11	13	8	6	7	8	6	5		
Swift & Co.			1											
U.S. Borax			5	6	5	7	4	3	2					3
U.S. Steel		2	2	1										
Western Eaton									3	4	5	4		
Misc. Vendors (Poor Xerox Copy)		2												
Total Railroad Cars Received	55	50	61	36	49	53	51	39	42	44	32	9	4	4
** Numbers in Table indicate number of railroad cars received														

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by the Oakland County Planning Commission, taken in 1980 and 1985. This practice was ended by May 1988, when the drum washing area was set up inside the building. All effluent from this process now drains into a closed (restricted to the facility) drainage system which is treated by the facility wastewater treatment system before being discharged into the city of Detroit's sanitary sewer.

## 6.0 IMPLEMENTATION OF INTERIM MEASURES

No interim actions have been taken, nor are any contemplated or recommended at this time due to the site conditions, extent and characteristics of the contamination, and the limited potential for any impacts on human health and/or the environment.





**TASK II**

**PREINVESTIGATION EVALUATION  
OF CORRECTIVE MEASURE TECHNOLOGIES**

## 1.0 EVALUATION OF CONTAMINANT MIGRATION

The MACDERMID Ferndale facility had voluntarily chosen previously to abandon operations and/or the associated equipment contributing to the sources of contamination related to the SWMU areas described in MACDERMID's Part B R. This removed the source of contamination directly from each SWMU, however, attempts to remedy the original contaminant contributions at each unit has not been put in a final status.

Analytical data previously collected at the site of the soils and ground water indicate that the primary inorganic contaminants are metals, essentially consisting of chromium, copper, nickel, zinc, and lead. These constituents, due to their chemical nature, do not migrate rapidly in soils. *depends on  
ph of soil - ph  
data was not  
taken*

Description of the soils in the near-surface and subsurface in this area are recorded on boring logs from the original building foundation investigation, McDowell and Associates borings in the IPC investigation (1987) and the Techna borings (1989) and are all in agreement. From 1 foot to between 7- and 13.25-feet deep, the soils are mixed clayey sands grading to sandy clay, underlain by a stiff blue clay across the entire site. This clay is a low permeability sealing unit. Vertical migration would be deterred at this clay horizon. However, some lateral dispersion on the clay surface will occur. Ground water does not appear to be contaminated according to water sample analyses collected from the previously installed monitoring wells. This is a shallow, unconfined aquifer and it is not used for human consumption.

Another critical factor influencing the rate of migration and horizontal extent of contamination would be gradient. This entire area is naturally very flat (see Figure 2.1 in Task I). This lack of slope is supported in the subsurface as well. Locally the natural shallow subsurface gradient is to the east and southeast. All surrounding areas drain toward the southeast corner of this site.

## 2.0 SCREENING OF REMEDIATION MEASURES

Several alternatives exist for the remediation of contaminated soils. In evaluating the applicability of the various remediation technologies, the nature and extent of the contamination must be considered, as well as the physical properties of the soil(s). A few of the methods available for soil remediation are:

- o Excavation, transportation, and off-site disposal
- o Thermal destruction
- o Containment (capping, slurry walls, etc.)
- o Solidification with concrete and/or other cementitious materials
- o Vitrification
- o Biodegradation
- o No action

This evaluation resulted in the early dismissal of several of the soil remediation options listed above based on more site-specific criteria such as logistics, economics, and technical adaptations and specifications.

- o Thermal destruction would be effective on the organic constituents but would not significantly reduce metals' concentrations. Air emissions from this technique maybe unacceptable in some areas restricting implementation of this method.
- o Biodegradation would be effective on organic constituents but would not significantly reduce concentrations of metals in a reasonable time frame.
- o Solidification will result in extensive handling of materials with minimal net effect on contaminant levels on site.
- o Vitrification is an unproven technology with high costs.

The three remaining remedial alternatives were reviewed as most applicable to this site:

- o Excavation, transportation and off-site disposal



- o Containment
- o No action

## 2.1 ON SITE REMEDIATION OPTIONS

The following summaries provide a more detailed discussion of the three alternatives for remediation at this site.

### 2.1.1 Excavation, Transportation, and Off-Site Disposal

This alternative involves the physical removal of contaminated site soils and their disposition in appropriate landfills.

#### 2.1.1.1 Materials Descriptions, Volumes, and Classifications

The results of the subsurface investigations conducted by McDowell and Associates, IPC, and Techna under the direction of MACDERMID, has identified the site soils as having metals' contamination with some organic contaminants restricted to one or both lagoons in the closed surface impoundment area (SWMU No. 1). Material volumes at SWMU #1 were calculated using the estimated areas and approximate thicknesses. Table 2.1 provides various depths for contaminated soil removal depending on the site specific clean-up levels (possibly MDNR industrial levels) to be determined. These metals' contaminated soils are nonhazardous in reference to off-site land disposal criteria.

In the particular case of the lagoon area (SWMU No. 1), organic constituents maybe associated with only certain sections in the lagoon(s). Previous soil sampling has revealed organic contaminants at 9- to 10.5-feet deep in Lagoon No. 1. This depth coincides with the bottom of the lagoon and/or stiff, blue clay layer underlying the site. Additional soil borings during the RFI field investigation may help in determining any further extent of organic contamination.

Soil material contaminated with organic constituents must be characterized prior to excavation and off-site disposal. TCLP analysis will be required before the material will be accepted by an approved waste disposal facility. If the contaminant concentrations exceed acceptable limits for land disposal on-site treatment to reduce contaminant levels will be required.

Costs involving the treatment and/or disposal of hazardous waste are high. This aspect of excavation, transportation, and off-site disposal may need to be reviewed further for a more cost effective method of remediation when the extent and levels of organic contamination at the site are more fully understood.

TABLE 2.1  
 EXCAVATION VOLUMES

<u>Soil Area</u>	<u>Estimated Surface Area (square feet)</u>	<u>Approximate Volume per Average Excavation Depth (cu. yd)</u>		
		<u>3 Feet</u>	<u>5 Feet</u>	<u>8 Feet</u>
SWMU No. 1: Two Closed Surface Impoundments				
Lagoons and areas south to fence	20,000-35,000	2,500-4,000	4,000-6,500	6,000-10,000
VOA contaminated	800			240
SWMU No. 3: Inactive Railroad Spur				
New building (Part B)	6,500	700	1,200	2,000
SWMU No. 2: Incinerator/Units That Emit Air Contaminants				
	5,500	600	1,000	1,600
TOTALS		3,800-5,300	6,200-8,700	9,840-13,840

In SWMU Nos. 2 and 3 (incinerator/air emissions and the inactive railroad spur) the contamination is restricted to metals in the soils. However, the extent of contamination can only be estimated at this time (see Table 2.1) due to a lack of sufficient data. Vertical contamination has been established from the previous borings in the area to be between 1- and 5-feet deep. The additional soil borings proposed in the Draft Work Plan for these SWMU areas are critical for a better definition of the spacial extent.

Once the extent of the contamination has been determined by sampling and analysis, the nonhazardous materials will be excavated and directly loaded into trailers. When the trailers are full they will be weighed, tarped, and washed for over-the-road transportation to a licensed nonhazardous or special waste landfill. Following the excavation, transportation, and off-site disposal method, short-term monitoring may be required at the site.

#### 2.1.2 Containment

This remediation alternative is a combination of containment methods that maybe applied to the particular SWMU area to which it is best suited.

##### 2.1.2.1 SWMU No. 1 - Two Closed Surface Impoundments/Lagoons

The analytical results of several soil borings advanced in Lagoon No. 1 indicated organic constituent concentrations to be present from 9.0- to 10.5-feet deep, decreasing upward in the soils. Because of the hazardous nature of these organic constituents, containment rather than excavation with the possibly of associated pretreatment before disposal for landfill acceptability, may be a more cost effective approach to dealing with the hazardous waste, as well as reducing owner off-site liability.

Two barrier walls could be constructed on the down-gradient sides of the lagoon (SWMU No. 1) area. The wall on the east side would be approximately 220-feet long and extend in a northeast-southwest direction from the southeast corner of the building to the south property line. This barrier wall would be joined to an east-west wall constructed parallel to the south property line. This east-west wall should extend approximately 260 feet along the southern boundary and abut the northeast-southwest wall.

The barrier walls could be constructed of concrete/bentonite grout. The base of the walls would be installed 5 to 10 feet into the stiff, blue, confining clay layer at approximately 7- to 13.25-feet deep. The barrier walls would be brought to the surface and any surface run-off would be diverted into the facility's wastewater treatment system before being released to the city of Detroit's combination storm/sanitary sewer.

A cap constructed of low permeability material over the contaminated portions of the SWMU surface areas would be beneficial in deterring migration induced in the soils from precipitation and surface water run-off. Capping may be used in conjunction with containment or separately as a barrier from surface waters to prevent contaminant migration through soil percolation.

#### 2.1.2.2 SWMU Nos. 2 and 3 - Incinerator/Units That Emit Air Contaminants and the Inactive Railroad Spur

The above described containment techniques could be applied to SWMU areas 2 and 3 when spacial and vertical extent of the metals contamination in these areas is more fully understood. From the available analytical data on the soils associated with SWMU Nos. 2 and 3, only nonhazardous metals are involved in these areas. If the limited extent of this contamination is confirmed by additional sampling, excavation, transportation, and off-site disposal may be a more practical, cost efficient approach for remediation in these areas.

It is important to note that containment/capping is also possible in the form of concrete slabbing for a floor or building foundation. The 1973 annex on the west side of the building may also be considered as a cap/containment for any possible contaminants associated with that area due to prior incinerator emissions or effects caused by the old outside container storage area located in this area.

The new upgraded hazardous-waste storage area is planned for construction over a substantial portion of the Railroad Spur Area (SWMU No. 3). This building extension could serve as a deterrent to migration from surface water. Once the downgradient, as well as contaminant boundaries to this SWMU No. 3 have been defined through additional sampling outlined in the Draft Work Plan, the establishment of this new hazardous-waste storage area may be included as part of the remediation process for this SWMU area.

Containment requires long-term, scheduled monitoring but it allows the contamination problem to be dealt with in a responsible manner on-site. The low permeabilities of the soils, the low potential for metals to migrate in the soils and the unimpacted shallow ground water at the site (according to IPC Report January 1987, ground-water analysis) all support the containment alternative based on the current data available on the site.

#### 2.1.3 No Action

This alternative addresses the soil contamination at this site as it is related to the native depositional sequences and the physical characteristics of the soil(s).



The overall low permeability (i.e. hydraulic conductivity) of the subsurface soils in this area, the sealing blue clay that uniformly underlies the site from approximately 7- to 13.25-feet deep and the low migration potential of metals in soil all substantiate the no action approach.

Ground-water yields are generally low in the glacial drift material and the shallow ground water is not used for human consumption in the area. The ground-water quality has not been impacted by contaminants from this site according to the IPC ground-water analysis in the report dated January 1987. Local ground-water gradient and surface drainage is toward, or into the southeast corner of this site from the surrounding areas. With sample verification as outlined in the Draft Work Plan, and close monitoring of the site with scheduled (biannual, quarterly) periods of sampling, a no action policy would be a practical and effective approach to remediation at this site.

## 2.2 OFF SITE

At present, no indication of off-site contaminant migration requiring remediation is apparent from the analytical and historical data available at this site. Shallow soil sampling along the Grand Trunk Railroad may be helpful in assessing contaminant levels associated with the first incinerator location on the west side of the property, as well as along the southern boundary, where perimeter borings indicated shallow, metals contamination.



**TASK III**

**RFI WORK PLAN**

## 1.0 INTRODUCTION

The following section describes the five components required in the RFI Work Plan. These components are necessary to establish a consistent and sound methodology for the successful implementation of the work plan:

- o Project Management Plan
- o Data Collection Quality Assurance Plan
- o Data Management Plan
- o Health-and-Safety Plan
- o Community Relations Plan.

A key factor in these components is flexibility. Though an RFI Work Plan should be rational and focused, it should also allow for timely work plan changes during implementation as warranted by the findings of the investigation. We believe that such flexibility is crucial to the successful completion of an RFI.

The five major components of the RFI Work Plan, as specified in Task III of the RFI, representing partial requirements for maintaining the Part B Permit are discussed in the following subsections.

### 1.1 PROJECT MANAGEMENT

Professional project management is a key factor to successful project completion within prescribed cost and time limits. The OHM project management structure is broken down into elements of project planning, project control, and project execution. The project management structure combines the various functional areas performing work on a project into a coordinated team reporting directly to the project manager. The objectives of the OHM project management approach are to produce quality work which meets all contract requirements, and to complete the project within the budget and schedule to the satisfaction of the client.

OHM project managers are experienced and trained in the methods of project management and execution. The project staff is also experienced and trained in executing projects for on-site hazardous-waste investigation and remediation activities.

The OHM project manager is supported by a senior technical advisory committee which provides guidance and technical advice on project execution issues and problems which may arise. Members of this staff are called upon on an "as needed" basis to assist in smooth project execution. The project manager is also supported by health-and-safety and quality assurance/quality control (QA/QC) staff to ensure



that the project is safely executed in compliance with applicable laws, regulations, statutes, and industry codes. As project complexity increases, additional staff and disciplines are added to meet project needs.

The OHM staff includes experienced professionals in many environmentally-related disciplines including: civil engineering, hydrogeology, geotechnical engineering, chemistry, construction engineering, construction estimating and scheduling, and environmental engineering.

## 1.2 DATA COLLECTION QA/QC PLAN

A detailed site-specific Data Collection QA/QC Plan is described in this work plan. At a minimum, this plan will address the following:

- o Data collection strategy
- o Sampling methods and field measurements
- o Sample analyses

A general discussion of data collection QA practices is included below.

Samples of sediments, soil, and ground water will be collected and analyzed for selected chemical and physical characteristics. The frequency and location of samples will be based on previous analytical results. If the investigation and the site reconnaissance indicate that other parameters need to be added to the testing program MACDERMID will be consulted. Standard approved procedures will be utilized for the collection, handling, preservation, and storage of the analytical samples. Chain-of-custody of the samples will be maintained and documented. To minimize the possibility of cross-contamination between sampling locations, all sampling equipment will be decontaminated before reuse. The analytical laboratory, Environmental Testing and Certification Corp. (ETC) in Findlay, Ohio, will incorporate a QA/QC program which is in accordance with approved protocol and procedures.

## 1.3 DATA MANAGEMENT PLAN

Since contaminant release characterization studies generate large amounts of data, a detailed Data Management Plan is included in this RFI Work Plan to document and track investigation data and results. OHM will utilize its extensive experience in computer-based laboratory data management to record, analyze, and display the analytical data from this project. OHM's database management system will be used to format the data and produce tabular and graphic output for the RFI report, including raw data tables, sampling location and grid maps, concentration isopleth maps, fence diagrams, and potentiometric maps.

#### 1.4 HEALTH-AND-SAFETY PLAN

A Health-and-Safety Plan is detailed in this work plan based on the results of existing records which describe known and potential hazards in the vicinity of the SWMUs. It is anticipated that the majority of the work will require Level D safety equipment with the ability to upgrade to Level C.

#### 1.5 COMMUNITY RELATIONS PLAN

A professional Community Relations Plan will be developed by MACDERMID in conjunction with OHM in response to information gathered on the potential impact to surrounding communities. Implementation of the Community Relations Plan is contingent upon the degree and extent of contamination found at the site and the degree of public interest in the project.

## 2.0 PROJECT MANAGEMENT PLAN

This section presents the Project Management Plan which includes the technical approach, project schedule, project budget, and a description of the project personnel.

### 2.1 TECHNICAL APPROACH

The technical approach of the RFI Work Plan for the three SWMUs is described in the following subsections.

#### 2.1.1 Ground-Water Monitoring Wells

A total of five 2-inch diameter stainless steel monitoring wells will be installed at this site. A hollow-stem auger drill rig with 6.25-inch inside diameter (ID) augers will be used to advance the boreholes as continuous 2-foot long split spoon samples are collected. Decontamination before usage and after each borehole according to Section 2.1.5 is required. Decontamination of the split-spoon sampler will be done prior to use and after each sample collected. The decontamination of the stainless steel monitoring well pipe will be done before installation.

Monitoring of the breathing air zone and field headspace screening of soil samples will be conducted using a photoionization detector (PID). Soil samples will be retained for laboratory analysis on the basis of headspace readings and visual inspection. Monitoring wells will be set between 15- and 20- feet deep as site conditions dictate. There will be 10 to 15 feet of screen in each well depending on the depth to water. When possible 5 feet of screen will be set above the water table depth. If water levels are above 10-feet deep, less than 5 feet of screen above the water table will have to suffice.

In an effort to screen the monitoring wells at the accurate depth to water, it is important not to sacrifice the necessary depth to ensure a good annular seal between the top of the screened interval and the ground surface. This seal must consist of a foot of bentonite approximately 1 to 2 feet above the top of the screened interval, followed by a concrete/grout mixture which is brought to within 0.5 feet of the surface. A manhole/road-box will be installed flush-mounted with the surface and sealed around the wellbore and on the surface with finishing cement. The monitoring wells will have sealing, locking well caps.

Two monitoring wells will be designed as upgradient background monitoring points for soils analysis and ground-water sampling (i.e., MW1 and MW2), (see Figure 2.1). The three additional monitoring wells will be located within the

DRAWING 9961A4-1 (FIG 2-1)

APPROVED BY

CHECKED BY

DRAWN BY  
C.E. MERRIN 1-30-91

OHM CORPORATION  
FINDLAY, OHIO

PLOT SCALE: 1" = 1'

DRAFT 2-2

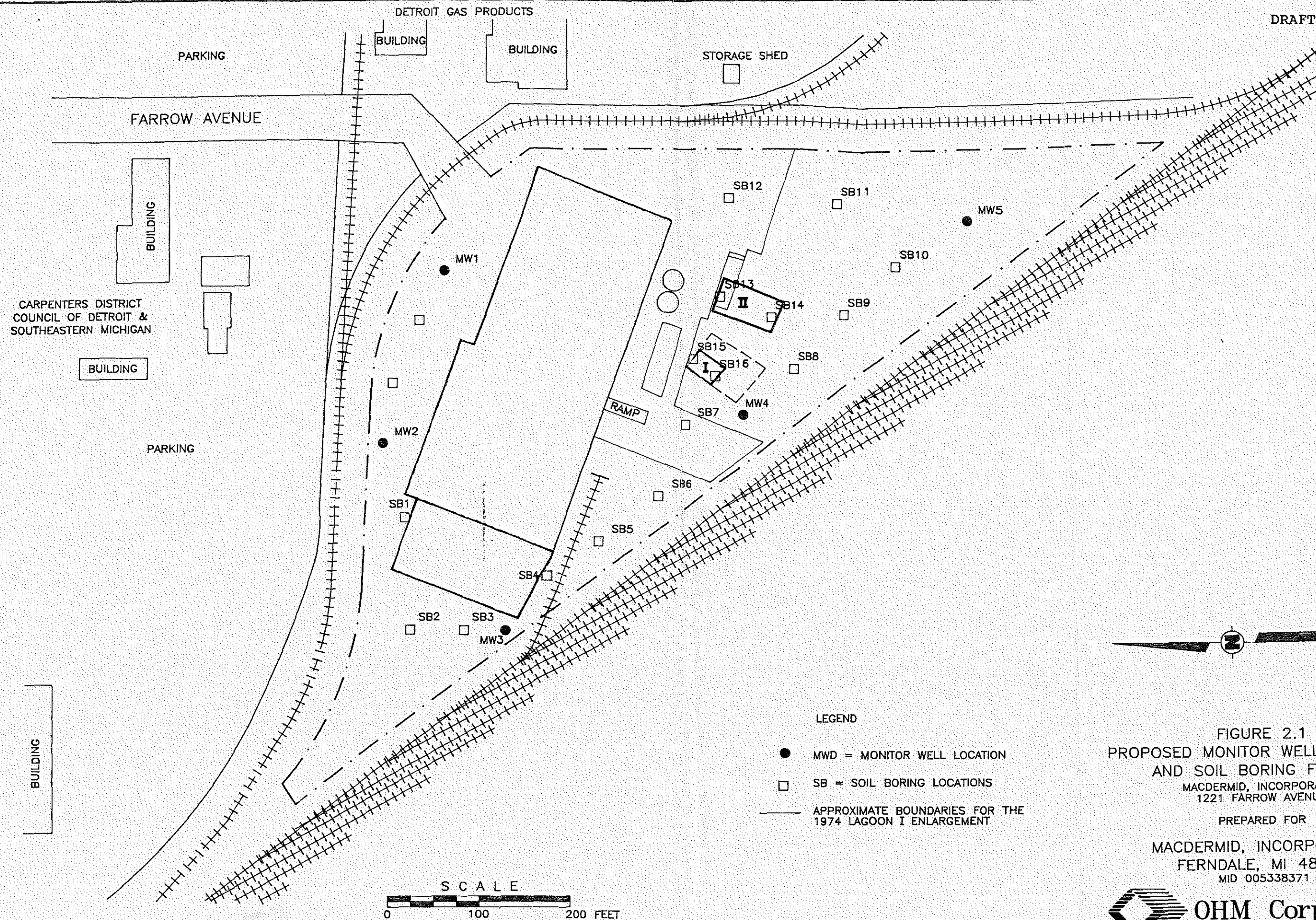


FIGURE 2.1  
PROPOSED MONITOR WELL LOCATIONS  
AND SOIL BORING FOR RF1  
MACDERMID, INCORPORATED  
1221 FARROW AVENUE  
PREPARED FOR

MACDERMID, INCORPORATED  
FERNDAL, MI 48220  
MID 005338371

 OHM Corporation



- o Dissemination of project-related information
- o Serving as liaison between the project staff and other internal groups; such as QA, health and safety, and the laboratory
- o Serving as the "collection point" for the project staff reporting of nonconformances and changes in project documents and activities and reporting changes in scope to the project director
- o Determination of the effect of the nonconformances and changes on the project and the appropriateness for reporting such items to MACDERMID, provision of appropriate documentation for any reporting, and initiating change orders for client approval
- o Notification of the project staff and QA personnel of project nonconformances and changes
- o Attendance of meetings and conferences between MACDERMID and OHM.

#### 2.4.3 Field Geologist/Hydrogeologist

The primary role of the field geologist/hydrogeologist is to directly supervise and coordinate the field activities. He/she is responsible to the project manager for health and safety, execution of on-site activities, and site administration including field accounting, purchasing, subcontracting, scheduling, and reporting. The field geologist will conduct daily progress reviews with the project manager and will report project progress, budget, and schedule and will initiate internal change orders. The field geologist/hydrogeologist will also review and approve project-specific documents and design drawings.

#### 2.4.4 Project Supervisor

All personnel working on the site ultimately report to this individual who has authority over all phases and is the senior OHM on-site representative. The project supervisor is the primary safety official at this site and is responsible for ensuring the safety plan is properly implemented and all activity is performed in a healthful and safe manner.

#### 2.4.5 General Foreman

This individual's duty is to disseminate information, assign tasks, and coordinate efforts between the multiple OHM crews. This person reports directly to the project supervisor.

#### 2.4.6 Foreman

This individual's duty is to coordinate the activities of a specific work crew. This person reports to the general foreman.

#### 2.4.7 Laboratory Manager

Responsibilities of the laboratory manager will include:

- o General supervision of laboratory
- o Collaboration with the project staff in establishing sampling and testing programs
- o Scheduling and execution of testing programs
- o Serving as liaison between the laboratory staff and other personnel
- o Serving as the "collection point" for the laboratory staff reporting of nonconformance and changes in laboratory activities
- o Notification of the laboratory and QA personnel of specific laboratory nonconformances and changes
- o Performance of data verification
- o Maintenance of laboratory data
- o Release of testing data and results
- o Calibration of equipment
- o Storage of samples

#### 2.4.8 QA Officer

The QA officer will provide guidance to the project staff for quality-related matters and perform project audits. The QA officer has the authority and freedom to identify quality problems; initiate, recommend, or provide corrective actions; and verify the implementation of the corrective actions. Other responsibilities include:

- o Notification of personnel of nonconformances and changes in QA procedures, including revision to this plan
- o Determination of audit schedule

#### 2.4.9 Health-and-Safety Manager

The health-and-safety manager is responsible for the development and administration of the project health-and-safety plan. He/she will provide the necessary guidance to the project and laboratory staff so they can safely perform their functions in accordance with federal and state regulations.

#### 2.4.10 In-House Review Committee

An In-House Review Committee will provide technical overview by qualified senior level executives and professionals. These individuals have been selected for participation for two reasons. First, they have proven academic and work experience records in specific areas related to the project so that their technical expertise is in the work being performed. Second, they will not be involved in the day-to-day activity of the project so that they can provide an objective overview and review of the work. This group will meet periodically to review technical progress of the project and advise the project staff. This provides an objective and independent peer review as well as providing senior level guidance to the project and critical review of reports prior to their issuance.

### 2.5 PROJECT COMMUNICATIONS

The project manager is responsible for project communications. Project-related information shall be routed to the project manager after the original is marked with the date received and the project number by a member of the project staff. The project manager or designee shall then determine which personnel should review the incoming materials and shall route the materials accordingly. As soon as is practical, incoming correspondence originals shall be placed in the project central file.

Outgoing project correspondence, reports, and drawings will be appropriately reviewed, approved, and, as required, signed prior to transmittal. Outgoing correspondence shall, at a minimum, be signed by the project manager or a key level individual assigned this responsibility by the project manager.

All communications shall be confidential to members of this investigation. Communications relative to the project which are initiated by third parties (e.g., media, interested individuals, and groups) will be referred directly to MACDERMID without comment.

SWMUS, downgradient. Soil boring and monitoring well locations were selected using 60-foot grid pattern with random locations.

#### 2.1.2 Soil Borings

Fifteen to twenty soil borings will be advanced using a hollow stem auger rig and a 2-foot long split spoon sampler. These borings will be advanced several feet into the blue sealing clay or 15 feet (which ever comes first). Soil descriptions will be noted and samples will be screened with a PID for headspace. From these headspace readings and visual inspection, specific samples will be selected and sent to the laboratory for analysis.

Upon completion of each boring and the necessary sampling immediately proceeding the advancement of the borehole, a grout slurry will be tremied into the abandoned boreholes and brought to surface. This will seal the borehole and prevent contamination from unnatural commingling of shallow aquifers and from outside/surface contaminants entering the open hole. Cuttings from the soil borings will be drummed, labeled, and staged for appropriate landfill disposal following the field investigation phase.

#### 2.1.3 Analytical

Ground-water samples will be analyzed in the laboratory for the following metals: arsenic, barium, cadmium, chromium (total), copper, lead, mercury, nickel, selenium, silver, and zinc. Organic compound analysis will include chlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, ethylbenzene, toluene, xylenes (total), methylene chloride, and bis(2-ethylhexyl) phthalate.

Soils analysis for inorganics will include the following: zinc, copper, chromium (total), nickel, and lead. VOC analysis of the soil samples will be confined to the SWMU No. 1 area (i.e. lagoon area). Organic analysis will be the same as those listed above for ground water.

#### 2.1.4 Soil Boring Locations

Soil borings will be located according to previous analytical and historical information available on the site. SWMU No. 1 (lagoon area) will require approximately nine soil borings (SB8, SB9, SB10, SB11, SB12, SB13, SB14, SB15, SB16) and two monitor wells (MW4 and MW5), (see Figure 2.1).

SWMU No. 2 (units that emit air contaminants--incinerator) involves two separate areas. The first location on the northwest side of the building involves four soil borings and possibly five. One boring will be placed at each



end (north and south) of the building annex area outside (SB1 and SB4). A boring may be needed inside the building annex as it was constructed after the incinerator had been moved or about the same time as when the annex was built. Two borings will be advanced to the west of the annex in conjunction with the higher emissions contaminant concentrations as determined by the ISCLT model.

The second incinerator location, on the south side of the building, had emission concentrations over the closed surface impoundment area. Sampling will be coincident for this incinerator's emissions with the sampling for SWMU No. 1 (lagoons).

SWMU No. 3 is called the railroad spur area, however, contaminants found may be more closely related to the drum wash area that was located on or near the east side of the present concrete ramped area. Evidence of this washing area can be seen in aerial photos dated 1980 to 1985 from the Oakland County Planning Commission. A soil boring in this ramped area (SB7) is proposed, as well as three additional borings westward and toward the building/railroad spur (SB4, SB5, and SB6).

#### 2.1.5 Decontamination Procedures

All bits, augers, sampling tools, and other drilling equipment that come in contact with the soils or ground water at each boring location will be decontaminated prior to initial usage on site and before being reused for another boring. In addition, the soil sampling device (split-spoon, core barrel, etc.) will be decontaminated before each sampling event.

Between soil borings, hollow-stem augers and associated equipment, will be decontaminated with a high-pressure steam cleaner. Detergent (biodegradable non-phosphatic,alconox) may be added to the steam if sticky, greasy, or oily residues persist on the equipment. Detergent-steam washes will be followed by a straight steam rinse.

Between sampling events, the sampling device and hand tools that contact the samples will go through a four-step decontamination procedure. These steps are:

- o A detergent (Alconox or equivalent) wash
- o Two potable water immersion rinses
- o A rinse with distilled water

As part of the project QA/QC procedures, samples of the potable water used for decontamination will be analyzed for

the constituents shown in Table 3.1. Additional decontamination methods, such as acetone or methanol rinses, will only be used if warranted by the type, extent, and physical characteristics of the contamination.

A decontamination area will be established on site. All decontamination water will be collected, contained, and disposed of in the MACDERMID wastewater-treatment system.

## 2.2 PROJECT IMPLEMENTATION SCHEDULE

The proposed implementation schedule is shown in Figure 2.2. The schedule becomes effective once the Draft RFI Work Plan (Operable Unit Nos. 1 and 2, Sampling Schedule) is submitted on February 26, 1991. Thereafter, the Draft Work Plan (Operable Unit No. 3, Sampling Schedule) is submitted on May 30, 1991. Further draft and final reports will be submitted on a periodic schedule as projected in Figure 2.2. The intervals of time allowed for USEPA and MDNR review of reports and work plans are speculative.

## 2.3 BUDGET

The estimated costs for implementation of the first three tasks of the RFI are summarized below:

- |   |           |
|---|-----------|
| o Task I: Description of Current Conditions                                   | \$ 31,425 |
| - File and document research  |           |
| - Maps and charts of site, localized description                              |           |
| - Nature and extent of contamination  |           |
| - Implementation of interim measures  |           |
| o Task II: Pre-Investigation Evaluation Of<br>Corrective Measure Technologies | 12,450    |
| - On-site criteria (corrective action)  |           |
| - Off-site criteria (corrective action)                                       |           |
| o Task III: Exploratory Site Evaluation                                       | 68,135    |
| - Five ground-water monitoring wells  |           |
| - 15 to 20 shallow boreholes total, to<br>investigate three SWMU areas        |           |
| - Borehole grouting   |           |
| - Laboratory analyses   |           |
| - Report, remediation conclusions/<br>recommendations                         |           |

ESTIMATED PROJECT TOTAL \$112,010

FIGURE 2.2: IMPLEMENTATION SCHEDULE: MACDERMID

DESCRIPTION		CALENDAR DAYS FOLLOWING EPA/MDNR APPROVAL OF WORKPLAN																											
		0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	210	240	270	300					
SWMU Number	Exploratory Site Evaluation Prep & Mobilization							***																					
1 & 3	RFI Tasks I & II & Draft Work Plan (Task III)	X																											
1 & 3	Final Work Plan						0																						
1	SOILS - Borings & ground- water samples							**																					
1	Soil sample analysis							*****																					
1	GROUNDWATER - Install monitor wells								****																				
1	GROUNDWATER - Gauge, develop & sample wells									*****																			
1	GROUNDWATER - Sample Analysis													*****															
2	Draft RFI Work Plan SWMU # 2	X																											
2	Final RFI Work Plan SWMU # 2						0																						
3	Soil borings & groundwater samples							**																					
3	Sample Analysis							*****																					
1 - 3	Draft Final RFI Report SWMU #'s 1- 3																									X			
1 - 3	FINAL RFI REPORT SWMU #'s 1, 2, & 3																										0		

SWMU # 1 = Two closed surface impoundment areas - Lagoon areas  
SWMU # 2 = Units that emit air contaminants (i.e., original location of incinerator & associated area,  
as well as scrubber units associated w/the recycling/reclaiming process)  
SWMU # 3 = Inactive Railroad spur  
  
X = Submittal deadlines for draft reports  
0 = Submittal deadlines for final reports

SWMU # 1 = Two closed surface impoundment areas - Lagoon areas  
SWMU # 2 = Units that emit air contaminants (i.e., original location of incinerator & associated area,  
as well as scrubber units associated w/the recycling/reclaiming process)  
SWMU # 3 = Inactive Railroad spur  
X = Submittal deadlines for draft reports  
0 = Submittal deadlines for final reports

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## 2.4 PROJECT PERSONNEL

The make-up of the OHM project team is illustrated in Figure 2.3. Resumes of these team members are contained in Appendix J and their responsibilities briefly described below.

### 2.4.1 Project Director

The project director is the prime client contact. The project director will coordinate the utilization of intra-company resources, and will approve all project work and any additions, deletions, or major changes to the scope of work. The project director is responsible for all contracts with MACDERMID. Project organization and management procedures are established by the project director. Oversight responsibilities provided by the project director include: review and approval of work scope, design drawings, budgets, schedules, and reports. The project director is responsible for issuance of reports required by MACDERMID. The project director will also direct financial reporting and approve sub-contractors.

### 2.4.2 Project Manager

The project manager is the point of contact for the day-to-day management responsibilities for technical, financial, and scheduling matters. The project manager will establish budgets and schedules, control project performance, manage project activities, and execute the scope of work. The project manager is responsible for project accounting and invoicing and answers to the project director as the main interface with program management. Other duties, as necessary include:

- o Procurement, along with administrative personnel, of materials and subcontractor services
- o Assignment of duties to the project staff and orientation of the staff to the needs and requirements of the project
- o Coordinating the efforts of the In-House Review Committee
- o Preparing, reviewing, and approving project reports, plans, documents, and design drawings
- o Approval of project-specific procedures and internally prepared plans, drawings, specifications, cost estimates, and reports



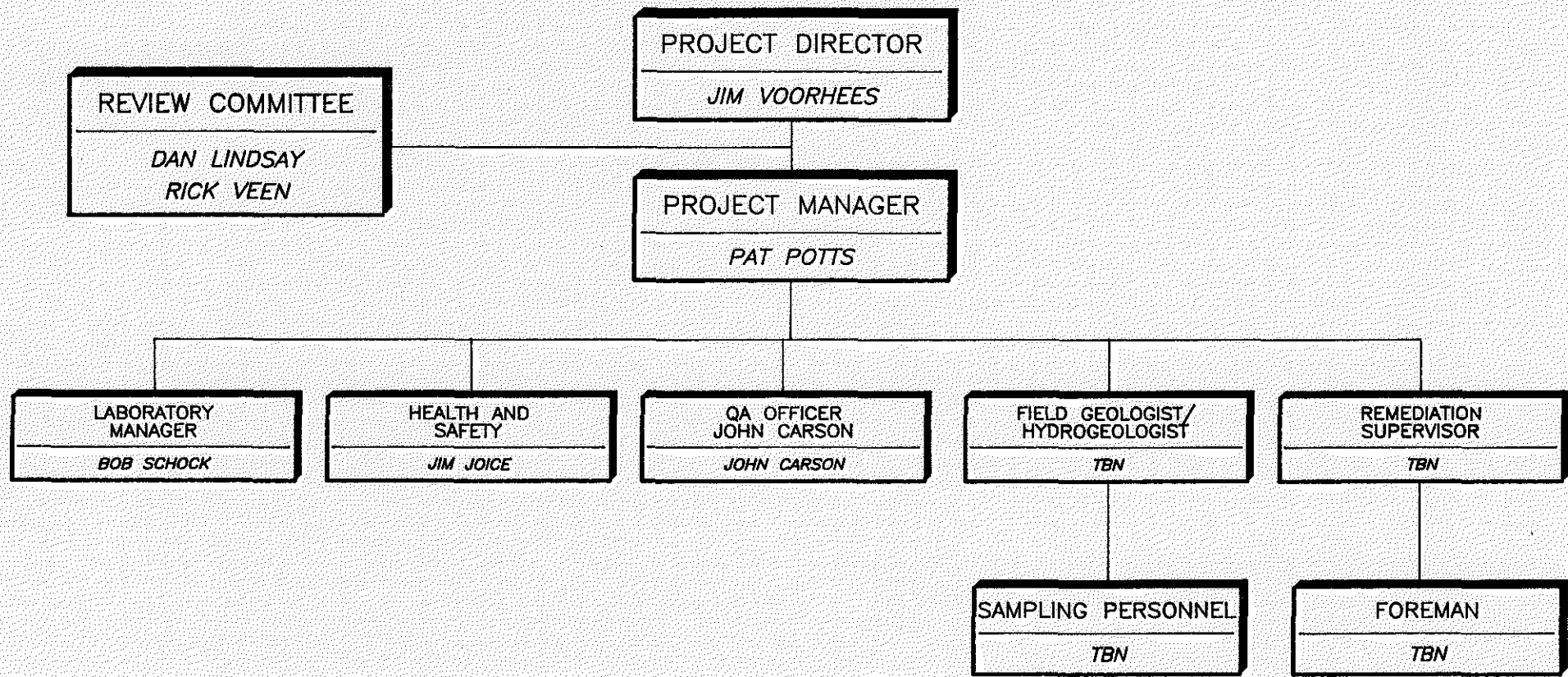


FIGURE 2.3  
 PROJECT ORGANIZATION  
 MACDERMID, INCORPORATED  
 1221 FARROW AVENUE  
 PREPARED FOR  
 MACDERMID, INCORPORATED  
 FERNDAL, MI 48220  
 MID 005 338 371

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February 26, 1991  
Revision 0

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In addition, OHM has numerous expert personnel in a wide variety of environmental services and engineering disciplines. These personnel can be called upon to provide assistance on most technical, logistical, and regulatory questions or problems that may arise.

### 3.0 DATA COLLECTION QUALITY ASSURANCE/ QUALITY CONTROL PLAN

A QA/QC program is an integral part of the RFI to assure the integrity and suitability of the investigatory program and resulting data. The QA/QC program describes overall implementation of field procedures and requirements for laboratory procedures.

The procedures that will be used for sample collection and analyses of ground water, surface water, and soil samples collected during the RFI at MACDERMID are described in this section. These procedures are used by OHM to perform sample collection and/or analyses as part of the RFI activities described in this work plan.

The procedures developed were based on the USEPA Ground-Water Monitoring Technical Enforcement Guidance Document (TEGD), and USEPA, SW-846 Test Methods for Evaluating Solid Waste.

Deviations from the procedures discussed in this section may be required due to circumstances arising during the course of a given sampling event. Deviations from the specified program and the purpose for the deviation will be clearly documented in the field. The deviations will be evaluated as soon after the sampling event as possible to evaluate the validity of the results and determine if resampling is necessary.

#### 3.1 SAFETY EQUIPMENT AND PRECAUTIONS

Measures will be taken to assure the safety of any individual(s) involved in a given sampling event. Rubber, nitrile or other waterproof gloves will be worn to prevent dermal absorption of hazardous compounds and contact with spilled fluids. Goggles or safety glasses with side shields will be worn to avoid water splashing into the eyes. Hard hats will be worn for head protection. Steel-toed boots are also required when working around heavy equipment. The use of air purifying respirators may be required at drilling sites. A PID will be used at drilling and sampling sites to detect the presence of volatile organic vapors. The requirements and decision tree for the use of special safety equipment is discussed in the health-and-safety plan in Appendix K of this work plan.

#### 3.2 PROCUREMENT/CONTROL OF SUBCONTRACTORS

The responsibility for quality compliance will be delegated to a subcontractor in the documents used to procure the subcontractor, provided that the subcontractor has a documented and acceptable QA program. If a subcontractor

does not have such a program, the conditions for performance of specific quality requirements will be specified in the procurement documents. These conditions are passed down so that the appropriate requirements can be met without asking subcontractors to have their own project applicable QA program.

Each subcontractor will complete the training required for implementing the health-and-safety program presented in Appendix K. Subcontractors will be required to complete and submit copies of project-related records to the project manager.

To verify subcontractor conformance to project quality requirements, OHM will, as necessary, perform field inspections, review subcontractor prepared documentation, and perform audits of subcontractor activities.

For field operations, project personnel will perform a QC inspection of any subcontractor used. The intention of this inspection is to verify that the subcontractor has fulfilled the requirements necessary to perform specific activities. The inspection will include the type and condition of equipment, calibration of equipment, and qualifications of personnel. If requirements are not met, sufficient grounds for suspensions of activities exist. Equipment which does not meet project requirements will not be used without repair to the satisfaction of the field geologist/hydrogeologist.

The results of the inspection will be documented in a memorandum by the field geologist/hydrogeologist to the project manager and QA officer.

### 3.3 WATER LEVEL DATA

#### 3.3.1 Air Monitoring In Wells

If a ground-water monitoring well is suspected of being highly contaminated or containing non-aqueous phase-separated liquid (NAPL) that may contain volatile constituents, the air space will be monitored using a PID in the monitoring well prior to any sampling. The air in highly contaminated wells may be sampled by inserting the probe of a PID about 4 inches into the well prior to taking a water level measurement, purging the well, or collecting a water sample. The PID will be calibrated using an appropriate calibration gas provided by the manufacturer. PIDs measure organic vapor present in the air in parts per million (ppm). Appendix L describes the type of meter that will be used. Measurements will be recorded in the field log book.



### 3.3.2 Ground-Water Level Measurement

The static water level will be measured in each well. In particular, the distance to the top of the water in the well from the top of the well casing will be measured. The measurement will be made from a surveyed reference point which is clearly and permanently marked on the top of the casing. This will enable water level elevations to be referenced to mean sea level (MSL).

The depth to water will be measured using an electric line (E-line) or the air pressure method where appropriate equipment is installed. All measurements and calculations made in the field will be recorded in the field log book.

#### 3.3.2.1 E-Line Method

The E-line method provides a direct reading of the distance to the water level utilizing a calibrated electric probe, water-level sensor, or equivalent measuring device. After removing the dedicated bailer present in the well, the E-line will be lowered down the well until the meter needle moves indicating contact of the probe with the water.

The water level will be measured before any water is removed from the well (i.e., prior to well evacuation during sampling events). Water levels will be measured to the nearest 0.01 foot. Any submerged portion of the water level measurement device will be rinsed with deionized water between wells so that it will not introduce external contamination into a well. In the case that an immiscible layer of hydrocarbon is present in the well, the submerged portion of the device will be wiped with hexane and rinsed with deionized water.

#### 3.3.2.2 Air Pressure Method

The air pressure method of measuring depth of water uses a bubbler device to measure the air pressure required to lift a column of water from the surface of the water to the top of the casing. The distance to the top of water is calculated as follows:

$$\text{Air pressure (pounds)} \times 2.31 = \text{feet of air space}$$

### 3.3.3 Detection of Immiscible Layers In Wells

During the initial sampling of the well, the well will be checked for the presence of NAPL before removing any water from the well. An interface probe will be used to determine the presence and measure the thickness of the immiscible layer(s) indicated by a beeping sound. These probes are designed to give a steady (continuous) tone when submerged in water. The probe will be slowly lowered into the well to

carefully measure the top and bottom of the light immiscible layer referenced to the TOC. After recording these data to the nearest 0.01 foot, the interface probe will be lowered to the bottom of the well to determine the presence of a heavier immiscible layer. All measurements made in the field will be recorded in the field log book.

A sample of the NAPL will be collected from the well. If the thickness of a light fraction NAPL layer is 2 feet or more, a decontaminated teflon sample bailer with a bottom check valve will be used for sampling. If the layer is less than 2 feet, a bailer modified to allow filling from the top will be used. If the NAPL occurs at the bottom of the well, a bailer with a bottom check valve will be used for collecting a sample.

The sample will be analyzed for specific gravity, or density with respect to water, and selected chemical parameters. The chemical parameters selected for analysis at each of the waste management units are presented in Table 3.1 of this work plan and are based upon previous analyses and site history.

#### 3.3.4 Monitoring Well Depth Measurement

After completion and development of each monitoring well, the depth to the bottom of the well casing will be measured, to determine if an appreciable amount of sediment has settled in the bottom of the well thereby obstructing the lower portion of the screened interval of the well. The procedure will be repeated at the time of each sampling event conducted in the investigation contained in this work plan.

The depth of the well will be measured using a weighted measuring tape constructed of inert materials or the interface probe. The depth measurement from the top of the casing will be compared to the original well depth on the well construction details. If the difference between the depth measurement and the original well depth is greater than 12 inches, the well may require additional development to remove the sediments and thereby provide for representative sampling results.

Sediments may be removed by bailing and surging techniques. The dedicated bailer is lowered to the bottom of the well and gently surged to fluidize and collect the sediment. The water is removed from the well and emptied into a container so that an estimate of the amount of sediment and a description of the material can be made and recorded. Bailing will be repeated until the sediments are removed and the turbidity is reduced. Purged water will be disposed of in the MACDERMID wastewater-treatment system.

### 3.3.5 Field Records

All measurements will be recorded in the field log book, or on a printed sampling information form similar to that shown in Figure 3.1. Particular care will be taken to accurately record units of measurement and the reference points from which the measurements were made.

## 3.4 SAMPLE COLLECTION

### 3.4.1 Ground-Water Samples

Wells installed as part of the RFI work plan will be sampled to determine the presence of chemical constituents. The following sections describe procedures to be used to collect RFI related samples from the monitoring wells.

#### 3.4.1.1 Well Evacuation

The purpose of evacuating water from the well prior to sampling is to eliminate stagnant water in the wellbore, thus allowing collection of a ground-water sample that is representative of the water quality in the formation.

The volume of water to be evacuated from the monitoring wells will be calculated during the sampling event, and will be based on the height of standing water in the well, i.e., the difference between the original total depth of the well and the measured water level depth.

A minimum of one to three well volumes of water will be evacuated from the well prior to sampling depending on the water yielding characteristics of the well. Low-yield wells (wells that can be bailed dry) will be evacuated to dryness once and allowed to recover before sample collection. Higher yielding wells will have a minimum of three casing volumes removed prior to sampling.

An effort will be made to avoid contamination of the bailer or bailer rope through contact with the ground. Where deemed appropriate, a clean plastic sheet will be placed at the base of the well while the well is being purged to avoid contact of the bailer or bailer rope with the ground surface.

Purged water will be contained in drums. The total volume of water evacuated from the well and the time involved in purging will be recorded. Purged water will be disposed of in the MACDERMID wastewater-treatment system.

#### 3.4.1.2 Sampling Method

Each ground-water well will be equipped with a dedicated teflon bailer. The bailer will be stored inside the well by suspending the bailer from a steel hook attached to the well

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FIGURE 3.1

SAMPLING INFORMATION FORM

SITE \_\_\_\_\_ PROJECT NO. \_\_\_\_\_  
SAMPLING POINT ID. (WELL NO.) \_\_\_\_\_ WEATHER \_\_\_\_\_

WATER LEVEL MEASUREMENT

Top of Casing Elev. (MSL) \_\_\_\_\_ ft. Orig. Well Depth \_\_\_\_\_  
Static Water Level Depth \_\_\_\_\_ ft. Date/Time \_\_\_\_\_  
Static Water Level Elev. (MSL) \_\_\_\_\_ ft. Technician \_\_\_\_\_

WELL DEPTH Date/Time \_\_\_\_\_ Technician \_\_\_\_\_  
Obstructed (Yes/No) \_\_\_\_\_ Depth to Well Bottom \_\_\_\_\_ ft.  
Sediment Thickness \_\_\_\_\_ ft. Removal Method \_\_\_\_\_  
Description of Sediment \_\_\_\_\_

PURGE DATA Method \_\_\_\_\_ Technician \_\_\_\_\_  
for 2-inch well (.16 gals/ft) x Height of \_\_\_\_\_ = \_\_\_\_\_  
for 4-inch well (.66 gals/ft) x Standing Water \_\_\_\_\_ = \_\_\_\_\_  
for 5-inch well (1.02 gals/ft) x In Well \_\_\_\_\_ = \_\_\_\_\_

	Volume (gallons)	Date/Time	Visual Turbidity/Color/Odor
Purge Volume 1	_____	_____	_____
Purge Volume 2	_____	_____	_____
Purge Volume 3	_____	_____	_____
Total Volume	_____	_____	_____

SAMPLING DATA Method \_\_\_\_\_ Date/Time \_\_\_\_\_  
Sample ID No. \_\_\_\_\_ Filter No. \_\_\_\_\_ Preservative \_\_\_\_\_  
Technician \_\_\_\_\_

FIELD PARAMETERS Technician \_\_\_\_\_

Time	Temperature (°C)	Specific Conductance (µmhos/cm)	pH (std units)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

NAPL MEASUREMENTS Technician \_\_\_\_\_

Interface Measurements from	FT BELOW TOP OF CASING	ELEVATION
(a) Air-light liquid	_____ feet	_____ feet
(b) Light liquid water	_____ feet	_____ feet
(c) Water-heavy liquid	_____ feet	_____ feet
(d) Bottom of the well	_____ feet	_____ feet
(e) Thickness of light liquid = (b - a) =	_____ feet	_____ feet
(f) Thickness of heavy liquid = (d - c) =	_____ feet	_____ feet



cap. The well will be sampled by slowly lowering the bailer into the water column, thereby minimizing degassing of the water. Once retrieved, the water collected in the bailer will be transferred to the sample container at a slow rate in order to minimize agitation and aeration of the water.

#### 3.4.1.3 Sample Containers

Bottles prepared according to USEPA specifications for environmental sampling will be provided by the laboratory performing the analyses. The bottles will not be opened prior to filling. Table 3.1 lists the bottle type to be used and the minimum volume of water to be collected for each specific analytical parameter.

#### 3.4.1.4 Order of Sample Collection

Samples will be collected and containerized in the order of volatilization sensitivity of the analytical parameters as follows:

- o Volatile organic compounds (VOC)
- o Extractable organics
- o Total metals

Table 3.1 presents a comprehensive listing of analytical parameters which will be used to assess contaminant migration for SWMU No. 1. VOCs will not be analyzed in samples collected in SWMU areas 2 and 3. Any additional constituents that are not listed in Table 3.1 will be analyzed following USEPA, SW-846 Test Methods For Evaluating Solid Waste. A select list of parameters will be applied to water or soil samples collected at each waste management unit.

#### Volatile Organics

Sample containers for VOCs will be filled with unfiltered water. The bottles will be carefully filled to ensure that there is no air trapped in the sample. Water will be slowly poured into the sample bottle to allow formation of a meniscus on the water surface in the bottle. Once the bottle lid has been secured, the sample will be checked for air entrapment by inverting the bottle, firmly tapping the bottle, and checking for air bubbles.

#### Extractable Organics

Sample containers for non-volatile organic analyses will not be rinsed in the field before sample collection. Containers will be completely filled.

TABLE 3.1: LIST OF ANALYTICAL PARAMETERS

ANALYSIS	USEPA ANALYTICAL METHOD (SW-846) *	DETECTION LIMIT**	BOTTLE TYPE & SAMPLE VOLUME	PRESERVATIVE	HOLDING TIME
<b>GROUNDWATER ANALYSES:</b>					
<b>METALS</b>					
Arsenic, total	7060	2	200 mls, P	HNO <sub>3</sub> , pH < 2	6 months
Barium, total	6010	10	200 mls, P	HNO <sub>3</sub> , pH < 2	6 months
Cadmium, total	6010	5	200 mls, P	HNO <sub>3</sub> , pH < 2	6 months
Chromium, total	6010	50	200 mls, P	HNO <sub>3</sub> , pH < 2	6 months
Copper, total	6010	10	200 mls, P	HNO <sub>3</sub> , pH < 2	6 months
Lead, total	6010	50	200 mls, P	HNO <sub>3</sub> , pH < 2	6 months
Mercury, total	7470/71	0.2	100 mls, P	HNO <sub>3</sub> , pH < 2	28 days
Nickel, total	6010	50	200 mls, P	HNO <sub>3</sub> , pH < 2	6 months
Selenium, total	7740	2	200 mls, P	HNO <sub>3</sub> , pH < 2	6 months
Silver, total	6010	10	200 mls, P	HNO <sub>3</sub> , pH < 2	6 months
Zinc, total	6010	10	200 mls, P	HNO <sub>3</sub> , pH < 2	6 months
<b>AROMATIC VOLATILE ORGANICS</b>					
Chlorobenzene	602/8020	0.2 [1]	40 mls, G T-L Septum	[2]	14 days
1,2-Dichlorobenzene	602/8020	0.4 [1]	40 mls, G T-L Septum	[2]	14 days
1,3-Dichlorobenzene	602/8020	0.4 [1]	40 mls, G T-L Septum	[2]	14 days
1,4-Dichlorobenzene	602/8020	0.3 [1]	40 mls, G T-L Septum	[2]	14 days
Ethylbenzene	602/8020	0.2 [1]	40 mls, G T-L Septum	[2]	14 days
Toluene	602/8020	0.2 [1]	40 mls, G T-L Septum	[2]	14 days
Xylenes	602/8020	Not Given	40 mls, G T-L Septum	[2]	14 days
<b>ADDITIONAL CONSTITUENTS</b>					
Methylene Chloride	8270	10	1L, G	Cool to 4 degree C	14 days
s(2-ethylhexyl)phthala	8060	10	1L, G	Cool to 4 degree C	14 days
<p>* All methods are from EPA SW-846, 3rd Edition - Alternate EPA-approved methods may be substituted for the specified method depending on the contract laboratory (ETC, in Findlay, OH)</p> <p>**Detection limits are Practical Quantification Limits (PQLs) for organic analytes and Method Detection Limits (MDLs) for metals and anions. Units are ug/L for water samples.</p> <p>[1] Determination of Practical Quantitation Limits (PQL) for groundwater matrices = PQL = [Method detection limit] x [factor of 10]. Sample PQLs are highly matrix-dependent. The PQLs given in this table are provided for guidance and may not always be achievable.</p> <p>[2] Cool to 4 degree C, 0.008% sodium thiosulfate, HCl to pH&lt;2</p> <p>**** (P) Polyethylene (G) Glass (T-L) Teflon-Lined</p>					

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**TABLE 3.1: LIST OF ANALYTICAL PARAMETERS CONTINUED**

ANALYSIS	USEPA ANALYTICAL METHOD (SW-846) *	DETECTION LIMIT ***	BOTTLE TYPE & SAMPLE VOLUME	PRESERVATIVE	HOLDING TIME
<b>SOIL ANALYSES:</b>					
<b>METALS</b>					
Chromium, total	6010	1000	10 g, Glass	HNO <sub>3</sub> , pH < 2	6 months
Copper, total	6010	200	10 g, Glass	HNO <sub>3</sub> , pH < 2	6 months
Nickel, total	6010	1000	10 g, Glass	HNO <sub>3</sub> , pH < 2	6 months
Zinc, total	6010	10	10 g, Glass	HNO <sub>3</sub> , pH < 2	6 months
<b>AROMATIC VOLATILE ORGANICS</b>					
Chlorobenzene	602/8020	0.2 [1]	5 g, Glass	[2]	14 days
1,2-Dichlorobenzene	602/8020	0.4 [1]	5 g, Glass	[2]	14 days
1,3-Dichlorobenzene	602/8020	0.4 [1]	5 g, Glass	[2]	14 days
1,4-Dichlorobenzene	602/8020	0.3 [1]	5 g, Glass	[2]	14 days
Ethylbenzene	602/8020	0.2 [1]	5 g, Glass	[2]	14 days
Toluene	602/8020	0.2 [1]	5 g, Glass	[2]	14 days
Xylenes	602/8020	Not Given	5 g, Glass	[2]	14 days
<b>ADDITIONAL CONSTITUENTS</b>					
Methylene Chloride	8270	500	10 g, Glass	Cool to 4 degree C	14 days
Bis(2-EH) phthalate	8060	200	10 g, Glass	Cool to 4 degree C	14 days
<p>* All methods are from EPA SW-846, 3rd Edition - Alternate EPA-approved methods may be substituted for the specified method depending on the contract laboratory (ETC, in Findlay, OH)</p> <p>**Detection limits are Practical Quantification Limits (PQLs) for organic analytes and Method Detection Limits (MDLs) for metals and anions. Units are ug/Kg for soil/sludge.</p> <p>[1] PQLs are highly matrix-dependent. The PQLs given in this table are provided for guidance and may not always be achievable. Thus, PQL = [Method detection limit] x [The following factors that that apply for the matrix involved, i.e., for low-level soil, water miscible liquid waste, high-level soil/sludge, or non-water miscible waste the factors that apply are 10, 500 1250, 1250, respectively].</p> <p>[2] Cool to 4 degree C, 0.008% sodium thiosulfate, HCl to pH&lt;2</p> <p>**** (P) Polyethylene (G) Glass (T-L) Teflon-Lined</p>					

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### Metals

Sample water for metals analysis will be filtered through a 0.45 micron filter unit before filling laboratory prepared bottles. New filters will be used for each sample. Tubing, if used for filtration, will be triple rinsed with distilled or deionized water before collection of the sample, or a new piece of tubing will be dedicated for each sample.

When the sample is too turbid to field filter, the sample will be put on ice in bottles with no acid preservative, and immediately delivered to the laboratory for filtration and acidification.

#### 3.4.2 Soil Sampling

Soil samples will be collected in order to determine the extent of contaminant migration from the investigated unit. The soil samples will be collected from continuously sampled borings. Once retrieved, the lithology of the soil sample will be logged by the field geologist/hydrogeologist. The procedures for performing soil borings and the requirement for boring logs are presented in Section 3.4.2.1.

The soil sample will be visually inspected for discoloration of soil by waste or product leachate. In addition, each split spoon sample will be tested for organic vapors using a calibrated PID. The PID will be calibrated using an appropriate calibration gas provided by the manufacturer. Organic vapor measurements will be recorded for each sample in units of ppm. The measurement of volatile emissions from the soil sample will serve as a qualitative indicator of contamination. All soil samples will be tested with the PID.

Samples that register organic vapor emission, indicating contamination, will be collected in glass jars for archiving until completion of the RFI. The first stratum encountered which does not exhibit obvious contamination, as determined from visual inspection and photoionization meter readings, will be collected for laboratory analysis. The sample collected for laboratory analysis will be immediately placed in a glass jar with a teflon-lined lid.

Since it is anticipated that many of the soil borings will be drilled in areas of potential contamination, the following procedure will be followed:

- o Prior to drilling, all augers, rods and core samplers will be cleaned with high-pressure water.
- o After obtaining a sample, the sampling device will be stacked in a separate pile for cleaning prior to reuse.



- o After describing the soil sample and retaining a portion of the sample in a glass jar, any remaining soil sample will be placed in a drum for storage and disposal.
- o After completion of the boring and installation of the well, any contaminated soils and discarded soil samples will be placed in drums for disposal at an approved landfill.
- o The augers, rods, and sampling devices will then be cleaned as described above and the next boring drilled.

Sampling equipment (i.e., Shelby tubes, trowels, etc.) will be cleaned thoroughly to minimize sample contamination and cross contamination. The cleaning procedure consists of washing off the sampling equipment with clean water, then rinsing with distilled water, then methanol or hexane, followed by a second rinse with distilled or deionized water.

The borehole will be terminated once the retrieved soil sample does not exhibit contamination or in the stiff, blue clay, whichever occurs first.

#### 3.4.2.1 Soil Boring Procedures

The hollow-stem auger (HSA) drilling method will be used for advancing all soil borings (in areas which are accessible to a drill rig) to be performed as part of this RFI. The HSA method is the preferred technique for performing soil borings in shallow unconsolidated sediments because this method does not introduce foreign fluids into the borehole which can interfere with analytical sampling results, and representative subsurface samples can be collected for analytical purposes.

All boreholes will be continuously sampled to define the stratigraphy and saturated intervals and allow for the collection of samples for chemical analysis as required. These samples will be obtained by using either a Shelby tube or split-spoon sampler, depending on the cohesiveness of the material sampled.

In areas which are not accessible to a drill rig, such as the basin, a hand auger or a small portable power auger will be used to perform the soil borings. The use of portable augers is generally not optimal for collecting continuous samples therefore, samples will be collected for examination at 2- to 3-foot intervals, if possible.

All samples and cuttings will be logged and inspected for signs of contamination by a qualified geologist or geotechnical engineer. A PID will be used as a field screening

tool for health-and-safety purposes and screening soil samples for headspace readings to determine whether or not the soil boring samples are contaminated. All soil borings will be grouted to the surface after sampling to avoid artificially induced soil contamination.

To safeguard against potential contamination, precleaned auger flights will be used. All auger flights will be steam-cleaned between each borehole before reuse. All Shelby tubes or split-spoon samplers used for collecting samples for analytical field screening or laboratory analysis will also be steam-cleaned between uses.

#### 3.4.2.2 Monitoring Well Installation Procedures

The HSA method will be used to install the new (shallow) wells as part of this RFI. This method is the preferred technique for shallow monitor well installation for the same reasons described previously. To provide an additional safeguard against potential contamination, precleaned auger flights will be used. All auger flights will be steam-cleaned between each borehole before reuse. All boreholes will be continuously sampled to define the shallow stratigraphy and determine the appropriate screen interval. All samples and cuttings will be logged and inspected for signs of contamination by a qualified geologist or geotechnical engineer.

Once the total depth is reached, the well casing and screen will be installed through the auger stem. Each auger will be slowly raised and removed, one flight at a time, to minimize formation collapse. The annulus will be sounded during this procedure to determine if collapse has occurred.

If little or no collapse is observed, filter sand will be poured into the annulus between the well casing and auger stem until the sand pack fills the wellbore annulus to the appropriate height relative to the screen. The slow withdrawal of the augers significantly reduces the suction effect which can cause formation collapse. If collapse does occur, the amount will be documented and the remaining annulus to be sand packed will be filled using this same procedure.

A minimum of 1 foot of bentonite pellets will then be placed on top of the filter sand. The preferred method of bentonite pellet placement is by dropping the pellets through the auger flight annulus, although this can result in bridging. If this occurs, the augers will be removed slowly, the borehole sounded, and then the bentonite seal placed.

### 3.5 FIELD PARAMETERS

Specific conductance, pH, and temperature will be measured in the field. These field parameters will be measured in sample aliquots collected after the laboratory samples are collected. Monitoring probes should not be placed in sample bottles containing samples for laboratory analysis. Temperature will be measured first to enable compensation of specific conductance to 25 degrees Celsius. Any sample odor and color will also be noted. The field parameter samples will be discarded upon completion of testing.

Four replicate measurements of pH and specific conductance will be performed on four replicate aliquots of water. These field analyses will be separated by a minimal time period (approximately 1 minute). Temperature measurement need only be performed before the first analysis to calibrate the probes.

Measuring and test equipment used in the field will be controlled by a formal calibration program. The program will provide equipment of the proper type, range, accuracy, and precision to provide data compatible with the specified requirements and desired results. Instrument calibration will be verified and recorded in the field log book before each sampling event. Responsibility for the calibration of field equipment rests with the individual performing the sampling. Instruments will be calibrated according to the manufacturer's recommended procedures each day prior to sampling. A record of calibration of the field instruments will be recorded in the log book or on sampling forms (see Figure 3.1). Acceptable limits or ranges in calibration accuracy will follow manufacturer's standards.

### 3.6 FIELD QA/QC PROGRAM

The field QA/QC program includes:

- o Documentation of sample collection methods  
(Section 3.4)
- o Calibration of field testing equipment  
(Section 3.5)
- o Handling of collected samples including sample preservation and chain-of-custody control  
(Sections 3.7 and 3.8)
- o Analysis and collection of duplicate, field and trip blanks is discussed in the following subsections.

### 3.6.1 Duplicate Samples

A duplicate sample will be collected for analysis of the same parameters as for the other samples at the waste management unit. A minimum of one duplicate sample will be analyzed for each media tested at each of the waste management units. The duplicate samples will be given a unique identification number to distinguish it from the primary sample. Sample bottles for the duplicate and primary sample will be filled as close together in time as possible. For example, after filling the bottle for the primary organic sample, the duplicate bottle will be filled before proceeding to collect samples for each chemical analysis.

### 3.6.2 Field Blanks

A field blank will be collected during the sampling event to determine potential adsorption of organics from the air into a sample. A field blank for organics will be collected by filling the sample bottles received from the laboratory with deionized water. The bottles will be filled at the well site and recorded on the chain-of-custody sheet. Sample bottles will be filled by pouring the deionized water into the sample bottles without involving any intermediary tubes or vessels. The bottles will be labeled "Field Blank" and standard chain-of-custody procedures will be followed.

### 3.6.3 Trip Blank

The trip blank will be used to detect and quantify potential chemical artifacts originating from sample containers, deionized water or laboratory handling procedures. One bottle of each type used for analyses (i.e., two 40 ml vials, one 1 liter glass amber) will be selected and filled with deionized water in the laboratory prior to field mobilization. These bottles will be transported to the sampling location and returned to the laboratory with the bottle sets used to collect the ground or surface water samples. The trip blank will not be opened in the field. Trip blanks will be subjected to the same analysis as the samples. The concentration levels of any contaminant found in trip blank will be noted and compared to the field sample results. If the levels in trip blank are significant, the site may need to be resampled.

## 3.7 SAMPLE PRESERVATION AND HANDLING

Sample preservation is intended to 1) retard biological action, 2) retard hydrolysis, and 3) reduce absorption effects. Preservation methods include pH control, refrigeration, and protection from light. The preservation methods to be used are described in the following section.



### 3.7.1 Water And/Or Solid Waste Parameters

The water samples collected for analysis will be stabilized as follows:

- o Volatiles - cool to 4 degrees Celsius
- o Semi-volatiles - cool to 4 degrees Celsius
- o Metals - pH less than 2 with  $\text{HNO}_3$  after filtration

The acid preservative will be added to the sample container in the laboratory prior to field mobilization. Samples will be preserved in the field immediately after sample collection by placing the samples in an insulated ice chest containing ice. Upon receipt, the authorized laboratory personnel will store and/or prepare the samples for analysis, taking into consideration sample holding times for the analytical parameter of interest.

### 3.8 SAMPLE DOCUMENTATION

A sample documentation program will be implemented to allow for the tracing of possession and handling of water and soil samples from the time of field collection through laboratory analysis. The program will include:

- o Sample labels which clearly identify samples
- o Sample seals to preserve the integrity of the sample from the time it is collected until it is opened in the laboratory
- o Field log book to record information about each sample collection during the monitoring program
- o Chain-of-custody record to establish sample possession from the time of collection to analysis
- o Sample analysis request sheets which serve as official communication to the laboratory of the particular analysis required for each sample and provide further evidence that the chain-of-custody record is complete
- o Laboratory logbook which is maintained at the laboratory and records all pertinent information about the sample

### 3.8.1 Sample Labels

To prevent misidentification of samples, legible labels will be affixed to each sample container. The labels will be sufficiently durable to remain legible even when wet and will contain the following information:

- o Project name and number
- o Sampling point identification name and/or number
- o Name or initials of collector
- o Date and time of collection
- o Analysis required (if space on label allows)

### 3.8.2 Sample Seals

In cases where samples are to be shipped off site, a security seal will be placed on the shipping container of individual bottles to ensure the samples have not been disturbed during transportation.

### 3.8.3 Field Log Book

A field log book or sampling information forms (see Figure 3.1) will be maintained for all sample collection activities. The following specific data will be documented where applicable:

- o Name of collector
- o Identification of sampling point
- o Depth to water in wells (referenced from top of casing)
- o Well total depth
- o Well yield characteristics
- o Well evacuation method
- o Purge volume
- o Method of measuring immiscible layer
- o Thickness of immiscible layer
- o Sample withdrawal procedures
- o Types of sample containers used
- o Preservatives used

- o Climatic conditions including air temperature
- o Sequence and time of field activities conducted
- o Results of field analyses
- o Field observations (broken lock, cracked casing, etc.)
- o Sample observations (color, odor, etc.)

#### 3.8.4 Chain-of-Custody Record

The ability to demonstrate that the samples were obtained from the locations stated and reached the laboratory without alteration is an important consideration. Evidence of collection, shipment, laboratory receipt, and laboratory custody until completion of analyses must be documented to accomplish this. Documentation will be accomplished through a chain-of-custody form that records for each sample the signature of the individuals collecting, shipping, and receiving the samples. An example of chain-of-custody record is included as Figure 3.2.

A sample is considered in custody if it is:

- o In a person's actual possession
- o In view, after being in physical possession
- o Locked so that no one can tamper with it, after having been in physical custody
- o In a secured area, restricted to authorized personnel

Chain-of-custody forms will be used by all personnel to record collection and shipment of all samples. A qualified laboratory will not accept samples collected for analysis without a correctly prepared chain-of-custody form. The chain-of-custody procedure will be as follows for samples of soil, sludge, and water subject to chemical or geotechnical analysis for this project:

- o The chain-of-custody record for all samples will be initiated in the field by the person collecting the sample. Each sample will be assigned a unique identification number that is entered on the chain-of-custody form. Samples can be grouped for shipment on a common form.



OHM Corporation

TGU 3.2

## CHAIN-OF-CUSTODY RECORD

Form 0019  
Field Technical Services  
Rev. 08/89

No. 87052

O.H. MATERIALS CORP. • P.O. BOX 551 • FINDLAY, OH 45839-0551 • 419-423-3526

PROJECT NAME		PROJECT LOCATION				NUMBER OF CONTAINERS	ANALYSIS DESIRED (INDICATE SEPARATE CONTAINERS)										REMARKS		
PROJ. NO.	PROJECT CONTACT			PROJECT TELEPHONE NO.			<div style="text-align: center;"> MID 005 338 171  February 26, 1991  Revision 0 </div>												
CLIENT'S REPRESENTATIVE				PROJECT MANAGER/SUPERVISOR															
ITEM NO.	SAMPLE NUMBER	DATE	TIME	COMP	GRAB													SAMPLE DESCRIPTION (INCLUDE MATRIX AND POINT OF SAMPLE)	
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			

TRANSFER NUMBER	ITEM NUMBER	TRANSFERS RELINQUISHED BY	TRANSFERS ACCEPTED BY	DATE	TIME	REMARKS
1						<div style="text-align: center;"> DRAFT 3-18 </div>
2						
3						
4						

SAMPLER'S SIGNATURE

LAB COPY



- o If the person collecting the samples does not transport the samples to the laboratory or deliver the sample containers for shipment, the first "Relinquished By", "Accepted By", entry will be completed in the field for the first transfer of possession.
- o The person transporting the samples to the laboratory or delivering them for shipment will sign the record form as "Relinquished By".
- o If the samples are shipped to the laboratory by commercial carrier, the chain-of-custody form will be sealed in a watertight container, placed in the shipping container, and the shipping container sealed prior to giving it to the carrier.
- o If the samples are directly transported to the laboratory, the chain-of-custody record will remain with the samples.
- o For samples shipped by commercial carrier, the waybill will serve as an extension of the chain-of-custody record between the final field custodian and receipt in the laboratory.
- o Upon receipt in the laboratory, a designated individual will open the shipping containers, compare the contents with the chain-of-custody record, and sign and date the record. Any discrepancies will be noted on the chain-of-custody form.
- o If discrepancies occur, the samples in question will be segregated from normal sample storage and the field personnel immediately notified.
- o The chain-of-custody form is completed after sample disposal. Samples not consumed during analysis will be kept for 6 months or as otherwise established by MACDERMID.
- o Chain-of-custody records, including waybills, if any, will be maintained with the records for the project, becoming part of the analytical data record.
- o The following documentation may supplement the chain-of-custody records:
  - Sample label on each sample

## FIGURE 3.3

## SAMPLING ANALYSIS REQUEST

MID 005 338 371  
February 26, 1991

DRAFT 3-20

~~Part I: Field Section~~

Collector \_\_\_\_\_ Date Sampled \_\_\_\_\_ Time \_\_\_\_\_ hours

Affiliation of Sampler \_\_\_\_\_

Address \_\_\_\_\_  
number street city state zip

Telephone ( ) \_\_\_\_\_ Company Contact \_\_\_\_\_

LABORATORY SAMPLE NUMBER	COLLECTOR'S SAMPLE NO.	TYPE OF SAMPLE*	FIELD INFORMATION**
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Analysis Requested \_\_\_\_\_

Special Handling and/or Storage \_\_\_\_\_

## PART II: LABORATORY SECTION\*\*

Received by \_\_\_\_\_ Title \_\_\_\_\_ Date \_\_\_\_\_

Analysis Required \_\_\_\_\_

\* Indicate whether sample is soil, sludge, etc.

\*\*Use back of page for additional information relative to sample location.

- Sample collection log and request for analysis forms (see Figure 3.3).

### 3.8.5 Laboratory Log

A log, either handwritten or computerized, will be maintained in the laboratory in order to document the processing steps which are applied to the sample. The laboratory log will include the time, date, and name of the person who performs each processing step. All sample preparation techniques and instrumental methods will be identified in the log. Experimental conditions such as the use of specific reagents, temperatures, reaction times, and instrument setting will be noted if different from those published in the method used. The results of the analysis of all quality control samples will be identified for each batch of samples analyzed. Section 3.10 provides a description of the laboratory QA/QC program which will be implemented by the contract laboratory selected by MACDERMID to perform the chemical analyses on the RFI samples.

## 3.9 ANALYTICAL PROCEDURES

### 3.9.1 USEPA Approved Methods

The analytical parameters, the appropriate USEPA test method for each parameter, and the test method detection limit are identified in Table 3.1. Test methods listed in Table 3.1 are taken from USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846. If USEPA approved methods other than those listed in Table 3.1 are utilized, they will be in accordance with the methods listed in one of the following publications:

- o Standard Methods for the Examination of Water and Wastewater, 15th Edition
- o Guidelines Establishing Test Procedures for the Analysis of Pollutants, Federal Register, October 26, 1984, Pages 43234 to 43442
- o Methods for Chemical Analysis of Water and Wastes, USEPA-625/6-74-003a, 1974
- o Methods for Chemical Analysis of Water and Wastes, USEPA-600/4-79-020, March 1979
- o Methods for Collection and Analysis of Water Samples for Dissolved Minerals and Gases, U565 Methods

### 3.9.2 Use of Alternative Methods

Any deviation from a USEPA-approved method will be adequately justified to ensure that the quality of the results meets the performance specification of the reference method. The method used must be fully documented to show that the method is accurate, reproducible, free of interferences, and sensitive. The limit of detection for the method should also be established with both clean standards and by spiking samples to determine the effect of the sample matrix.

If a method is selected instead of an existing USEPA-approved method, approval from USEPA will be obtained in accordance with procedures outlined in PB87178349, Test Method Equivalency Petitions; A Guidance Manual.

The use of an alternate method in place of an approved method will not be permitted until the previously-mentioned work has been completed, submitted to USEPA, and approval of the proposed method received.

### 3.10 LABORATORY QA/QC

#### 3.10.1 General Laboratory Testing Procedures

Laboratory testing will be performed in accordance with documented and approved procedures by trained personnel using calibrated equipment. Analytical testing will be controlled by formal laboratory QC programs (e.g., method certification, reagent blanks, method blanks, field blanks, duplicates, check standards, internal standards, spikes, and statistical analysis of results). Test performance, QC analyses, and results will be documented using standard data forms/formats. The reduction of test data will undergo formal documented verification.

##### 3.10.1.1 Laboratory Testing Program Initiation

Upon receipt at the laboratory, a designated individual (e.g., QC coordinator or sample custodian) shall:

- o Examine all samples and determine if proper environmental conditions have been maintained during shipment. If samples have been damaged during shipment, the remaining samples shall be carefully examined to determine whether they are affected. Any samples affected shall be considered damaged. It will be noted on the chain-of-custody record that specific samples were damaged and that the samples were removed from



the testing program. Field personnel will be notified as soon as possible that samples were damaged and that they must be resampled, or the testing program changed.

- o Compare samples received against those listed on the chain-of-custody.
- o Verify that sample holding times have not been exceeded.
- o Sign and date the chain-of-custody form and attach waybills to the chain-of-custody.
- o Place the samples in appropriate laboratory storage.
- o Enter the chemical samples in a laboratory sample log-in book which contains the following information:
  - Project identification number
  - Sample numbers
  - Type of samples
  - Date received in laboratory
  - Date put into storage after analysis is completed (This last item will be added to the log when the action is taken)
- o Place the chain-of-custody records in the laboratory project file.

The testing programs will, as necessary, be summarized on project data summary sheets and kept in a file folder in the laboratory project files. These folders will serve as a receptacle for completed laboratory data sheets as analyses are finished by individual analysts.

#### 3.10.1.2. Data Validation

Laboratory data reduction and interpretation calculations will be independently checked. Below is an outline of the methods that must be used for verifying chemical testing data. At least 20 percent of all chemical analysis data will be checked in this manner. If, during the checking process, errors are determined, checking will be performed for 100 percent of the data set.

- o The analyst performing the data processing will give the data package to an analyst independent of the work for checking. The package will include, as appropriate, raw data, data sheets, strip charts, computer input/output, calculations, sources for input parameters such as response factors, etc.
- o The independent analyst (checker) will, as applicable, review the data for:
  - Appropriateness of equations used
  - Correctness of numerical input
  - Numerical correctness of calculations
  - Correct interpretation of strip charts, etc.
- o All entries and calculations that the checker reviews will be marked. The checking process must be thorough enough to validate that the results are correct. If the checker disagrees with any part of the computations, the checker will mark through the number with a single line and place the revised number above it.
- o Any changes made by the checker will be back-checked by the originator. If the originator agrees with the change, no action is necessary. If the originator disagrees, the originator and checker must resolve the differences so they agree with the result presented.
- o The checker will sign the originals and date all pages of the data package (except for groups of printout data such as chromatograms). Signing and dating indicates that the reviewer agrees with the calculations and that any changes made have been agreed to by the originator.
- o If the data have been processed by computer, the reviewer will check every input entry. Agreement should be indicated by a check mark for every line. If the checker disagrees with the input, the number should be marked through with a line and the corrected number indicated above it. Corrections must be back-checked by the originator as discussed above.

If an input error is identified and the data have been processed, it will be necessary to reprocess the data. In this event, the checker will mark the second set of input to indicate agreement with the input changes. The checker will sign and date the computer input to indicate agreement.

The process must be satisfactorily completed for the data to be considered valid.

The laboratory manager or designee will review testing results prior to external distribution. The review will:

- o Compare analyses performed to the proposed testing record
- o Review results for reasonableness and consistency of reporting limits
- o Review quality control data results
- o Verify that required checking was properly performed
- o Review sample preservation and any holding time requirements

If the review indicates that the data meets project quality requirements, the data will be released as "final" information.

#### 3.10.2 Laboratory Chemical Analysis

All ground water, surface water, and soil samples collected from the site, and blanks will be analyzed using laboratory methods which conform, as a minimum standard, with test methods outlined in USEPA SW-846 (September 1986). (see also Section 3.9 Analytical Procedures). The actual references will be maintained in the laboratory for use by laboratory personnel.

#### 3.10.3 Laboratory Geotechnical Procedures

Applicable ASTM or USEPA procedures will be utilized for all geotechnical laboratory testing. The following controls are routinely implemented for geotechnical testing, and will be employed for this project:

- o Proper storage of samples
- o Use of qualified technicians
- o Use of calibrated equipment
- o Formal independent checking of computation and reduction of laboratory data and results
- o Use of standardized test procedures

The laboratory manager is responsible for the implementation of these controls on a continuing basis.

#### 3.10.4 Documentation

Laboratory testing programs will utilize prepared forms to systematically and uniformly document administrative and technical information. These forms will be available prior to initiating the testing programs.

Test data forms will be completed during the testing and subsequent data reduction. All requested information will be addressed. This information will include, as appropriate:

- o Project name and number
- o Identification of test personnel
- o Testing date
- o Identification of calibrated equipment used  
(test equipment list giving equipment name and unique identification number)
- o Identification and description of sample(s) tested
- o Test data and any subsequent data reduction
- o Test results in the form of tables and curves
- o Unusual conditions encountered

The collection and analysis of quality control data will be documented on test data forms and quality control data forms and charts. The data should include the evaluations of reagent/method blanks, field blanks, duplicate samples, matrix spikes, and surrogate standards.

Laboratory administrative forms, test data, quality control data, computer printouts, and checkprints will be organized and maintained by the cognizant laboratory in the laboratory files.

### 3.11 EVALUATION OF THE QUALITY OF THE ENVIRONMENTAL DATA

#### 3.11.1 Reporting of Concentration Values

Values that are "less than" a limit of detection can result when:

- o Constituents are present at very low concentrations



- o An insensitive analytical technique has been used
- o The chemical matrix of the sample interferes with the analytical technique

The detection limit and quantification limit of analytes will be established by determining the noise level of response for each sample in the batch. If the analyte is present, the noise level adjacent in retention time to the analyte peak may be used. For wave-length dispersive instrumentation, multiple determinations of digestates with no detectable analyte may be used to establish the noise level. The method of standard additions should then be used to determine the calibration curve using one digestate or extracted sample in which the analyte was not detected. The slope of the calibration curve,  $m$ , should be calculated using the following relations:

$m$  = slope of calibration line

$S_B$  = standard deviation of the average noise level

$MDL = KS_B/m$

For  $K = 3$ ;  $MDL$  = method detection limit

For  $K = 5$ ;  $MDL$  = method quantitation limit

Reported detection limits for a specific compound will be checked for variation between sampling points. Where detection limits are high, the limit will be reduced in future samples, if possible, by using alternate laboratory procedures that remove or control interfering constituents.

### 3.11.2 Missing Data Values

Care will be taken to complete all analyses specified in the RFI Work Plan in order to provide a complete data set for statistical comparison.

### 3.11.3 Outliers

An observation which is very different from all other observations in a group of observations is called an outlier. Causes for outliers in ground-water samples may be due to:

- o A catastrophic occurrence such as a spill
- o Inconsistent sampling or analysis procedures
- o Errors in transcription of the data values

Any outliers reported in the MACDERMID RFI data will be evaluated for cause and, where possible, corrected. Documentation of the cause of the outlier will be provided prior to correcting or excluding data values from evaluations. Where the cause of the outlier cannot be attributed to sampling, laboratory or reporting error, the value will not be excluded from the data base.

#### 3.11.4 Units of Measure

Units of measure will be specified after each quantity reported for the specific analyte.

#### 4.0 DATA MANAGEMENT PLAN

The following procedures have been established to effectively manage the chemical and physical data which will be generated during the course of the RFI implementation.

##### 4.1 DATA REDUCTION

Data reduction will be performed in a planned and controlled manner. Performance responsibility rests with the project manager. Prior to initiating any data reduction, the project manager or representative will discuss the scope of the work, contractual and regulatory requirements, and applicable QA procedures with assigned personnel.

##### 4.1.1 Calculations

Calculations will be legible and in a form suitable for reproduction, filing, and retrieval. Documentation will be sufficient to permit a technically-qualified individual to review and understand the calculations and verify the results.

Calculations should, as appropriate, include a statement of calculation intent, description of methodology used, assumptions and their justification, input data and equation references, numerical calculations including units, and results.

Computer printout that becomes an integral part of the calculations will be referenced in the calculations by run number or other unique means of identification.

##### 4.1.2 Computer Programs

Computer output will be dated and clearly identified as to contents. Large sets of output will be labeled with project name and number, program used, analysis title, and the user's name.

##### 4.1.3 Logs, Drawings, and Tables

The results of analysis, assessment, and modeling activities may be presented in logs, drawings, and tables of various forms. The format of logs and tables will be governed by the information to be presented.

Drawings will be uniquely identified by drawing or figure number and appropriate title. Standardized symbols or nationally accepted drafting standards will be used. References to other drawings and sources of information will be provided, as necessary. Drawings will be signed and dated by the draftsman performing the work and the responsible member of the project group who has checked the drawing.

## 4.2 DATA VALIDATION

Calculations, computer program input, logs, drawings, and tables will be formally checked using the standard process outlined in the following sections.

### 4.2.1 Calculations

Verification of calculations will be performed by an individual(s) other than the persons who performed the original work, or specified the method or input parameters to be used. The individual(s) selected will have technical expertise in the calculation subject.

### 4.2.2 Computer Program Input

Computer input will be formally checked using the standard OHM process outlined in Section 4.2.1 above. A single exception to this process is that the checking may be performed on the input originals. The verification will include a conceptual review of the program itself based on the problem being solved, a review of the computer model employed, a check that the program has been verified, and a formal check of the input data.

### 4.2.3 Drawings and Maps

Drawings and maps will be checked according to the same procedures as for calculations (see Section 4.2.1). Checkprints of the same drawing or map will be marked CP1, CP2, etc., to show progression of the checking process.

If a drawing or map is revised, the entire checking process will be repeated for the revised areas only. A new checkprint will be prepared. Under no circumstances will revisions be made without the formal checking procedure.

### 4.2.4 Logs and Tables

Final subsurface boring logs will be verified by the responsible member of the project team. The verification will provide that changes from the original field logs to the final log sheets are consistent with the results of other investigations. The final log sheets will be checked in the same manner as all calculations or drawings, with the checker signing and dating all checkprints.

In addition, all final tables presenting information, data, or the results of analyses will be checked (see Section 4.2.1). Checkprints of the same table will be marked CP1, CP2, etc., to show progression of the checking process.



#### 4.3 CHANGE CONTROL

It is imperative that an up-to-date status reporting system be maintained for all project work. An appropriate system for tracking the status of project work items includes:

- o Formal documentation of design drawings and revisions
- o Identification, documentation, and reporting of nonconformances
- o Documentation and approval of changes

##### 4.3.1 Change Control

During the course of work, changes from original design documents, procedures, and specifications must be expected. Changes do not imply a nonconformance to the work, but simply mean that original plans must be altered because of information or events that occur during the work.

Changes must be documented, evaluated, and reported as necessary so that the effect of the changes upon the course of the project can be evaluated. Changes must be managed so that the actual course and results of the project, not the original plan, can be demonstrated and justified to be of acceptable quality and fulfill the project objectives.

It is the responsibility of all project personnel to appropriately record any changes and to make the documentation available as appropriate to project management. The effect of the change upon the project will be evaluated by the project management team, QA personnel, MACDERMID, and subcontractor management as appropriate.

Project documents as discussed below must be reviewed, approved, distributed, and revised as necessary. This will provide for dissemination of approved and up-to-date project data and drawings.

##### 4.3.2 Review and Approval of Documents

Prior to use for scientific or engineering evaluations, documents must be reviewed and approved by the appropriate project team members:

- o Originator
- o Field geologist/hydrogeologist
- o Project manager
- o Project director
- o QA officer

Approval of the above documents and design drawings will be denoted by a signature and date. All documents and design drawings will be internally reviewed and approved before they are submitted to MACDERMID for their review and approval. If MACDERMID requests a copy of a document or a design drawing before it has gone through the complete review and approval process, then this document or design drawing will be marked "preliminary." Consensus between OHM and MACDERMID will be reached before a document or design drawing is issued as final.

#### 4.3.3 Distribution

Documents and design drawings will be distributed as needed to MACDERMID. When a document or design drawing is no longer needed, it will be returned to the issuing group. The QA officer will control distribution of all quality-related documents, and the project manager will control distribution of all other documents and design drawings.

#### 4.3.4 Revision of Documents and Design Drawings

Whenever a document or design drawing is revised, review and approval of the revision will be in accordance with the requirements of the original document or design drawing.

#### 4.3.5 Document Status

To prevent the inadvertent use of obsolete or superseded project-related information, all members of the project team are responsible for reporting changed documents and design drawing status to the project manager. In turn, the project manager (or designee) will notify affected personnel of the resulting status change in project documents and design drawings.

#### 4.4 NONCONFORMANCE/CORRECTIVE ACTION

Nonconforming items and activities are those which do not meet the project requirements, procurement document criteria, or approved work procedures. Nonconformances may be detected and identified by:

- o Project Staff--During the performance of field investigation and testing, supervision of sub-contractors, and preparation and verification of numerical analyses.
- o Laboratory Staff--During the preparation for and performance of laboratory testing, calibration of equipment, and QC activities.
- o QA Personnel--During the performance of audits.

Each nonconformance affecting quality will be documented by the personnel identifying or originating it. For this purpose, a standard form (e.g., Nonconformance Report or Variance Log), results of laboratory analysis QC tests, audit report, internal memorandum, or letter will be used as appropriate. Documentation when necessary, include:

- o Identification of the individual(s) identifying or originating the nonconformance
- o Cause and description of the nonconformance
- o Any required approval signatures
- o Method(s) for correcting the nonconformance (corrective action) or description of the variance granted
- o Schedule for completing corrective action

#### 4.5 QA AUDITS

To verify compliance with specific project QA program requirements, QA personnel will perform planned and documented audits of project activities. These audits will consist, as appropriate, of an evaluation of QA procedures and the effectiveness of their implementation, an evaluation of work areas and activities, and a review of project documentation. Audits will be performed in accordance with written checklists by trained personnel and, as appropriate, technical specialists. Audit results will be formally documented and reported to the project management.

Audits may include, but not be limited to, the following areas:

- o Subcontractor capabilities and performance
- o Field operations and records
- o Laboratory testing and records
- o Equipment calibration and records
- o Identification and control of samples
- o Calculations, logs, or tables
- o Computer program documentation and verification
- o Transmittal of information
- o Record control and retention

Planned audits for this project will, as appropriate, cover the field activities, laboratory activities, design and documentation, and final reports.

#### 4.5.1 Performance of Audits

A field operations audit will be performed by a QA auditor or project management staff member. Items to be examined may, as appropriate, include the availability and implementation of approved work procedures; calibration and operation of equipment; labeling, packaging, storage, and shipping of samples obtained; site investigation and testing performance documentation and checking; subcontractor performance; and nonconformance documentation.

The auditing of laboratory testing records will include, but not be limited to, laboratory data sheets, data verification, and data presentations prepared by the laboratory staff for the project.

A report audit may examine, as appropriate, the documentation and verification of field and laboratory data and results; performance, documentation, and verification of analyses; documentation and verification of computer programs; preparation and verification of drawings, logs, and tables; content, consistency, and conclusions of the report; compliance with regulatory and project requirements; and maintenance and filing of project records.

The report preparation process will be reviewed to verify that:

- o The report correctly and accurately presents the results obtained by the project work.
- o Information presented in the report is substantiated by project work.
- o The logs, tables, and figures presented in the report are prepared and checked according to specified requirements.
- o The report satisfies the scope of work, project requirements, and pertinent regulations.

During an audit and upon its completion, the auditors will discuss the findings with the individuals audited and cite corrective actions to be initiated. Minor administrative findings which can be resolved to the satisfaction of the auditors during an audit are not required to be cited as items requiring corrective action.

#### 4.5.2 Report To Management/Project Response/Closure

Following completion of an audit, the auditors will prepare and submit an audit report to the project director and, as appropriate, to the project manager, laboratory manager, senior field investigation geologist/hydrogeologist, and corporate director of quality assurance.



If corrective action is required in the audit report, the corrective action will be undertaken and completed on schedule unless sufficient evidence can be provided by the project management team receiving the audit report to prove that the action is unnecessary.

#### 4.6 RECORDS ADMINISTRATION

This project will require the administration of on-site, laboratory, and office project record files. The records systems managed by the project manager or designee will provide adequate control, confidentiality, and retention for project-related information. Record control will include receipt from external sources, transmittal, transfer to storage, and indication of record status. Retention will include receipt at storage areas, indexing and filing, separate and locked storage and maintenance, and retrieval.

##### 4.6.1 Record Control

Following receipt of information from external sources, completion of the field activities, completion of analyses, and issuance of reports or other transmittals, associated records will be submitted to the office project files. This will include records generated by subcontractors. Records will be legible and easily identifiable. In addition, field records and records transmitted between the contractor and subcontractor offices will be adequately protected from damage and loss during transfer (e.g., hand carrying or making copies prior to shipment).

Records submitted to the project file, with the exception of correspondence, should be bound, placed in folders or binders, or otherwise secured for filing.

##### 4.6.2 Record Retention

Information associated with the project will be retained in the office project files. These files will include the following:

- o All project materials
- o Records related to laboratory analysis
- o Check prints
- o Original drawings
- o QA records

Project records will be received and managed by the designated personnel. Designated personnel will check that incoming records have proper identification for filing, are legible, and are in suitable condition for storage. Indexing and filing of records will be performed only by the designated personnel.

For the project central file, the individual file folders will be divided into appropriate categories based on content, and numbered and filed sequentially within each category. A numbered index for the project central file will be prepared and maintained. The index will list the individual file folders and identify the records therein to facilitate locating the records. The index will be kept in a separate folder at the front of the project file. If appropriate, information on project material not stored in the project central file should be included with the index.

## 5.0 HEALTH-AND-SAFETY PLAN

The Health-and-Safety Plan for the field RFI work is presented in Appendix K.

## 6.0 COMMUNITY RELATIONS PLAN

Throughout the implementation of the RFI, MACDERMID will endeavor to keep the Ferndale community apprised of developments should there be releases of hazardous constituents from a SWMU that could affect the surrounding community. The measures that MACDERMID will undertake to keep the community informed will include on-site discussions with local officials and citizens groups, informal public meetings, and formal public notices, depending on the information being conveyed.

### 6.1 PUBLIC MEETINGS

If releases from the SWMUs are detected that may have a significant impact on the surrounding community, MACDERMID will schedule public meetings to convey appropriate information concerning local impacts and response actions that MACDERMID will pursue. Technical personnel from MACDERMID and the investigation team will be present to answer any questions that the community may have concerning the site investigation.

In the event that a public meeting is scheduled, the public will be notified by official public notice in the local Royal Oak Daily Tribune at least 1 week in advance of holding the meeting.

### 6.2 OFFICIAL PUBLIC NOTICE

In the event that the RFI results in a determination of no further action required for a particular SWMU, MACDERMID will apply for a permit modification to the existing MACDERMID RCRA Permit No. MID 005 338 371. Official public notice of the change will take place in compliance with the MDNR regulations. Notice will be published in the Royal Oak Daily Tribune, and announcements will be made over local radio stations.